A RECONNAISSANCE OF ASBESTOS DEPOSITS IN THE SERPENTINE BELT OF NORTHERN CALIFORNIA

BY F. J. WIEBELT AND M. CLAIR SMITH

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A RECONNAISSANCE OF ASBESTOS DEPOSITS IN THE SERPENTINE BELT OF NORTHERN CALIFORNIA[1/]

by

F. J. Wiebelt[2/] and M. Clair Smith[2/]

SUMMARY

Production of small tonnages of asbestos has been reported from 18 California counties; 16 additional counties have occurrences of asbestos. The counties in the northern part of California that have had a recorded production are: Alameda, Amador, Calaveras, Contra Costa, El Dorado, Napa, Nevada, Placer, Shasta, Siskiyou, Trinity, and Tuolumne. No deposit in the State has maintained consistent production.

Serpentinized peridotites (potential chrysotile-bearing rocks) are widely distributed in the coast ranges, Klamath Mountains, and western foothills of the Sierra Nevada.

Occurrences of chrysotile and amphibole asbestos of fair quality have been known in California for many years, but industry has been slow to explore them thoroughly. Of those occurrences that have been prospected or worked, none has shown a sufficient reserve of good-quality chrysotile asbestos for it to be classed as commercially important. The concentrations of chrysotile asbestos seldom exceed 5 percent, the grade above which deposits are considered to have commercial interest.

Small quantities of asbestos have been produced and sold intermittently in California since 1882, but the first year of recorded production was 1887. The year of peak value and of peak output was 1955.

Some chrysotile deposits in northern California, specifically in Calaveras, Napa, Nevada, Shasta, Siskiyou, and Tuolumne Counties, are of fair size, and indications are that a considerable output of chrysotile fiber might be obtained from them, should suitable exploration and development work be done.

Amphibole asbestos deposits in Shasta and Placer Counties await development of an expanded market for tremolite and anthophyllite asbestos.

1/ Work on manuscript completed April 1957.

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INTRODUCTION

This paper is one of a series covering the mineral resources of the Nation. It briefly describes most of the known asbestos deposits of northern California.

Information from field examinations was supplemented by that from reports and publications of the Bureau of Mines, Federal Geological Survey, and the California Division of Mines.

HISTORY

Small quantities of asbestos have been mined and sold intermittently in California since 1882. Before 1900, the entire production was classed as amphibole asbestos and was obtained mostly from small deposits in San Bernardino, San Diego, Calaveras, Riverside, El Dorado, and Placer Counties. There has been no prolonged consistent production in the State, and the development of the known deposits has been disappointing.

A summary of the more important occurrences of chrysotile, tremolite, and anthophyllite varieties of asbestos in northern California follows:

The American Asbestos Mining Corp. in 1953 leased a chrysotile asbestos property in Calaveras County about 7 miles southeast of Copperopolis. Development was begun about 1904, and operations continued intermittently until 1923. A small crushing and fiberizing mill began to operate in 1921. A small tonnage of fiber was used in acoustical and fireproof plaster. In 1944-45 considerable core drilling was done by the Johns-Manville Co.

The Morgan deposit in Placer County was developed intermittently during the period of 1905-13. This property is about 1 mile south of Towle and in 1908 had a reported production of 70 tons of asbestos. The deposit contained tremolite asbestos having long, gray-green, silky, flexible fibers of excellent grade. The asbestos was distributed in the deposit too sparsely to permit further exploitation.

In 1913 localities on Mears Creek in Shasta County and one deposit near Monticello in Napa County attracted attention.

Tremolite occurring as small lenses and pockets in peridotite has been mined and shipped from the Sylvester amphibole asbestos mine and the Stock property in the Mears Creek area from 1942 to the present. The Stock property contains a deposit of slip-fiber anthophyllite which has a variable thickness up to 3 or 4 feet and can be traced more or less continuously for nearly 1 mile.

The Monticello asbestos mine is in Napa County, 8.5 miles south of Monticello. Kohler & Chase built a mill on the property in 1941. Short-fiber chrysotile was produced from 1941 to 1945. The product was used in stucco and plaster for fireproofing war plant buildings. This property was purchased in 1955 by Patrick M. Tabor and the name of the property now is the Tabor Mining Co.

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A deposit of white slip-fiber tremolite near Iowa Hill, Placer County, discovered about 1913, was worked in 1944, 1946, 1948, and 1953-56.

In 1914 there was great activity in prospecting and developing asbestos properties in the vicinity of quicksilver mines northeast of Carrville, Trinity County.

The Jones Bros. deposit, 2 miles northwest of Carrville, Trinity County, in 1930 yielded a small tonnage of good-quality crossfiber chrysotile.

In Alameda County a small tonnage of short-fiber chrysotile asbestos was mined in 1915 and 1918 from a small deposit in the N1/2, sec. 36, T. 1 S., R. 3 W. The fiber was used in manufacturing asbestos-stucco flooring and steampipe covering.

The Stark deposit in Nevada County, about 1 mile west of Washington, mined and milled about 8,000 tons of asbestos-bearing serpentine between 1917 and 1923. The deposit contains crossfiber chrysotile asbestos. Portions of the property were core-drilled in 1951, under the Defense Mineral Exploration Administration (DMEA) program, by the Philip Carey Manufacturing Co.

The Sylvester deposit (also known as the Shasta View prospect) situated in Siskiyou County, 3 miles by road south of Edgewood, produced several tons of crossfiber chrysotile asbestos in 1921.

The Red Mountain deposits, approximately 2 miles south of Red Mountain, were located in 1949 and 1950. Chrysotile asbestos is present in shear fractures in serpentine. The asbestos-bearing serpentine occurs so sporadically and in such small quantities that no single deposit is large enough to warrant mining.

The Premier mine in Tuolumne County, about 2 miles northwest of Jamestown, is an unusual deposit in which the ore is mainly antigorite, a brownish-green lamellar variety of serpentine cut in places by small seams and stringers of short crossfiber chrysotile. This deposit is large, and future development depends upon profitable commercial uses for asbestos of this grade.

The Mount Eddy prospect is in Siskiyou County about 14 miles by road northwest of the city of Mount Shasta. Crossfiber chrysotile occurs in peridotite in an area roughly 900 feet long and 100 feet wide. Further exploration is needed to determine the magnitude of the deposit and the grade and quality of the fiber in the unweathered portion of the deposit.

The value of asbestos production in California since 1887, as given in the records of the California Division of Mines, 1887 to 1934, and the Federal Bureau of Mines, 1935-56, is shown in table 1. The figures in the table represent both chrysotile and amphibole. Before 1900 the entire output was classed as amphibole. Some details are combined to avoid disclosing individual mine production.

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TABLE 1. - Mine production of asbestos in California, 1887-1956

Year	Short tons	Value	Remarks
1887	30	$1,800	
1888	30	1,800	
1889	30	1,800	The only U. S. production.
1890	71	4,260	
1891	66	3,960	
1892	30	1,830	
1893	50	2,500	The only U. S. production.
1894	50	2,250	San Diego County (50 tons).
1895	25	1,000	Placer County (25 tons).
1896	-0-		
1897	-0-		
1898	10	200	Riverside County (10 tons).
1899	30	750	Riverside County (30 tons).
1900	50	1,250	Riverside County (50 tons).
1901	110	4,400	Riverside County (110 tons).
1902	-0-		
1903	-0-		
1904	10	162	El Dorado County (10 tons).
1905	112	2,625	El Dorado County (112 tons).
1906	70	3,500	El Dorado County (20 tons-$1,000), Placer County (50 tons-$2,500).
1907	70	3,500	Placer County (70 tons).
1908	70	6,100	Placer County (50 tons-$5,000), Amador County (10 tons-$1,000), Riverside County (10 tons-$100).
1909	65	6,500	Placer County (60 tons-$6,000), Amador County (2 tons-$200), Riverside County (3 tons-$300).
1910	200	20,000	Placer County (200 tons).
1911	125	500	Placer County (125 tons).
1912	90	2,700	
1913	47	1,175	Shasta County.
1914	51	1,530	
1915	143	2,860	Placer, Contra Costa, Calaveras, Alameda Counties.
1916	145	2,380	Shasta County.
1917	136	10,225	Placer, Nevada, Fresno, Inyo Counties.
1918	229	9,903	Alameda, Calaveras, Nevada Counties.
1919) 1920)	131	6,240	Shasta, Nevada Counties
1921	410	19,275	Shasta, San Benito, Nevada, Monterey Counties.
1922	50	1,800	Shasta, San Benito, Monterey Counties.
1923	20	200	Shasta, San Benito, Monterey, Nevada Counties.
1924	70	$4,750	Shasta, San Benito Counties.
1925) 1926)	25	1,650	San Benito County.
1927) 1928) 1929)	13	1,160	
1930	219	6,175	Shasta, Monterey, Riverside Counties.
1931	-0-		
1932) 1933) 1934)	309	3,274	Napa County.
1935) 1936) 1937) 1938) 1939) 1940)	-0-		
1941) 1942) 1943) 1944)	848	23,842	Napa, Inyo, Shasta Counties.
1945) 1946) 1947)	78	7,663	Napa, Shasta, Placer Counties.
1948) 1949) 1950) 1951)	181	14,849	Shasta, Placer, Inyo Counties.
1952	-0-		
1953) 1954)	220	14,605	Placer, Siskiyou, Tuolumne, Riverside Counties.
1955) 1956)	1,553	28,860	Inyo, Napa, Placer, Riverside Counties.
Total	6,272	$235,803	

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GENERAL GEOLOGY

Asbestos deposits are found in altered magnesium-rich ultrabasic rocks and in limestone near the contact with sills or intrusive sheets of basic igneous rocks (29, pp. 311-312).3/ The ultrabasic rocks vary in composition from dunite through peridotite to pyroxenite. In California potential chrysotile-bearing rocks (serpentinized periodotite or dunite) are widely distributed in all counties of the coast ranges, Klamath Mountains, and western foothills of the Sierra Nevada (15, p. 121). The serpentine generally occurs as elongated masses that tend to be oriented parallel to the regional structure. The size of the outcrops of these masses of serpentine ranges from less than 1 acre to more than 100 square miles. The distribution of serpentine in California is shown in figure 1.

Chrysotile asbestos occurs mainly in veins and veinlets in shear fractures in the serpentine.

Tremolite and anthophyllite asbestos occur in veins mostly as slip fiber, generally in rocks high in magnesian content. In some deposits of amphibole asbestos, the entire rock is made up of fibers with no discernible regular orientation. These deposits are termed mass fibered.

Tremolite-asbestos occurrences are common in the State but are generally limited to small pockets and narrow veins. The location of reported asbestos deposits in northern California is shown in figure 2.

VARIETIES OF ASBESTOS

Asbestos is the name used to designate the naturally fibrous varieties of serpentine or amphibole. The variety of asbestos in commonest use is chrysotile; the other varieties belong to the amphibole group. Amphibole-asbestos production in California has been almost entirely of the fibrous varieties of tremolite and anthophyllite.

Chrysotile is a fibrous variety of serpentine having the chemical formula $H_4Mg_3Si_2O_9$. It is formed only where there is serpentization, but serpentine may occur without chrysotile. Chrysotile occurs as crossfibers in which the fibers extend across a vein at or nearly at right angles, or as slip fiber where the fibers intersect the vein walls at low angles. Good-quality chrysotile fibers are silky, flexible, and have a high tensile strength. If long enough, the fibers may be used for spinning. Chrysotile is decomposed by acids, whereas amphibole varieties of asbestos are acid resisting.

Fibrous tremolite ($CaMg_3$, $(SiO_3)_4$) and anthophyllite ($(MgFe)SiO_3$) asbestos are usually found in fault zones as slip-fiber veins; that is, the fibers roughly parallel the walls of the veins. Tremolite and anthophyllite asbestos are especially suitable for use in filtration because they resist attack by acids. The fibers lack tensile strength, and those of anthophyllite in particular are brittle.

3/ Underlined numbers in parentheses refer to items in the bibliography at the end of this report. Pages cited refer to those in the items and not in this report.

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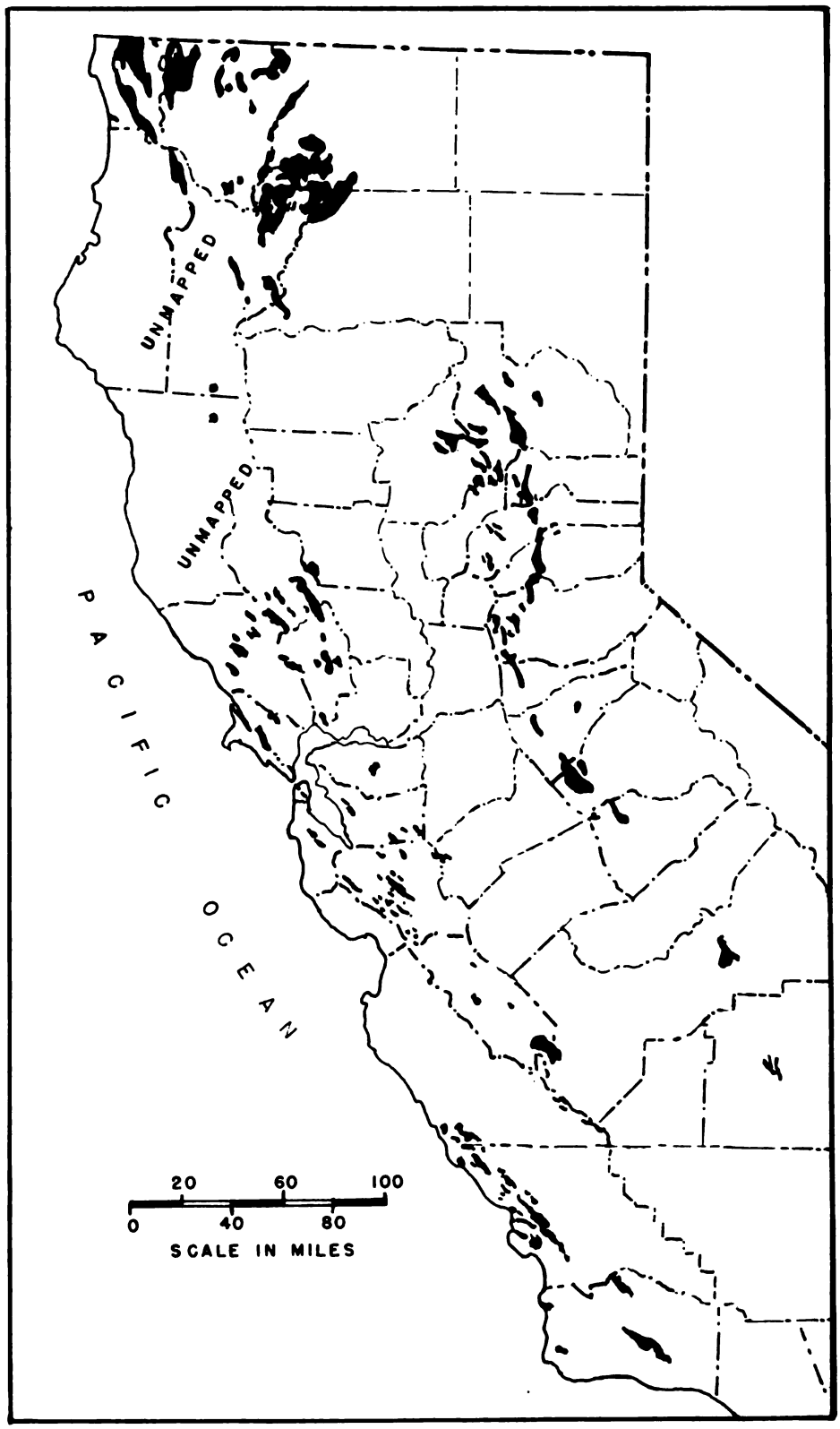

FIGURE 1. - Map Showing Distribution of Serpentine in California.
(From California State Division of Mines Map.)

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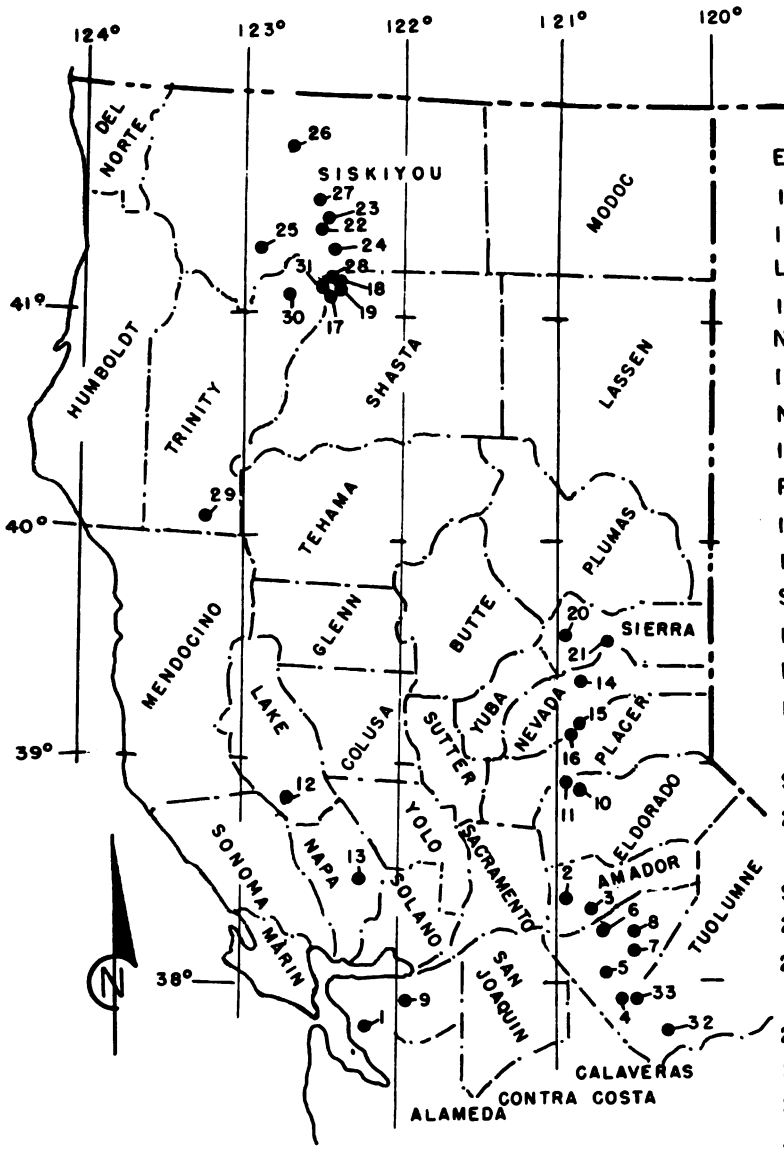

EL DORADO COUNTY
10 El Dorado Copper Co.
11 French Hill claims
LAKE COUNTY
12 Copsey and Jones prospect
NAPA COUNTY
13 Tabor Mng,Co.(Monticello)
NEVADA COUNTY
14 Stark deposit
PLACER COUNTY
15 Morgan asbestos deposits
16 Iowa Hill asbestos deposits
SHASTA COUNTY
17 The Bias corp.
18 The Stock asbestos property
19 Sylvester amphibole asbestos mine
SIERRA COUNTY
20 W. W. Casserly prospect
21 Lloyd and Milward prospect
SISKIYOU COUNTY
22 Mt. Eddy asbestos deposits
23 Shasta View(Sylvester asbestos prospect)
24 Calethia group
25 Keystone asbestos claims
26 C.C. Cady asbestos prospect
27 Chamberlain(Burns) Ranch
TRINITY COUNTY
28 Trinity asbestos claims
29 Red Mountain asbestos deposit
30 Jones Brothers asbestos mine
31 White Cloud prospect
TUOLUMNE COUNTY
32 Ashley asbestos property
33 Premier asbestos mine

ALAMEDA COUNTY
1. John D. Hoff Asbestos
AMADOR COUNTY
2 Mace Ranch
3 George Thomas
CALAVERAS COUNTY
4 American Asbestos Mng. Corp.
5 Turner and Lloyd prospect
6 Nuland and Nuner
7 Unnamed
8 Unnamed
CONTRA COSTA COUNTY
9 Drumeller asbestos deposit

FIGURE 2. - Map Showing Location of Reported Asbestos Deposits in Northern California.

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MILLING

Methods (10, p. 1) used at various mills vary in detail but are nearly all alike in principle. Fiber is separated from the barren rock by repetitive crushing, screening, and air suction.

A typical mill flowsheet would include primary and secondary crushing to a 3-inch size, furnace drying to remove moisture, and third-stage crushing to free the fiber. The third-stage crushing product, about 1/2-inch size, flows to a longitudinal shaking screen. While it proceeds along the screen, gravity concentration occurs, producing a layer of lightweight fiber on top and a layer of heavier rock on the bottom. The lightweight fiber is removed through a suction hood installed at the end of the screen. The oversize is crushed to 1/4-inch size and rescreened as outlined above. The undersize is fed to a fiberizer, consisting of high-speed hammers that break the rock by impact, making a further separation of rock and short fibers. The latter are separated by another suction-screening operation. When free, the fiber is passed to a 2-level screen for size classification. The shorts drop through both screens, the medium-length fiber is removed by air suction from the end of the lower screen, and the long fiber is similarly removed at the end of the top screen.

PHYSICAL PROPERTIES OF ASBESTOS

Physical properties that good asbestos fibers must possess include (16, pp. 51-55): Good fiber length, good flexibility, high tensile strength, high heat-insulating value, high melting point, resistance to alkalies and acids, and high electrical insulating value; moreover, the fiber filaments should exhibit a fine silkiness and pure white color and have good spinnability, to permit weaving into fabrics.

The chief requirements of filter-fiber asbestos are a fairly long fiber, and such chemical composition that it is virtually unaffected by common alkalies and acids.

There are so many diversified uses for asbestos that all of the above physical properties are not necessary for any single use.

GRADING, TESTING, AND USES
(9, pp. 83-84)(16, pp. 51-55)(30, p. 16)

The grading of asbestos for market varies in different localities. Vermont and Canada have the same classification for chrysotile. In the Canadian classification there are two main groups, crude and mill fiber, each of which is subdivided into subgroups.

Crude fiber, which commands a higher price than the mill product, is defined as "hand-selected, crossvein material essentially in its native or unfiberized form."

According to Canadian classification, the standard grades of crude asbestos are:

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Group 1:

Crude No. 1 - consists basically of crude, 3/4-inch, staple or longer.

Group 2:

Crude No. 2 - consists basically of crude, 3/8-inch, staple to 3/4-inch.

Crude Run-of-Mine - consists basically of unsorted crudes.

Crudes Sundry - consists of crudes other than above specified.

In Arizona the term "crude" differs from the above Canadian definition, because the fiber-bearing rock is reduced in jaw crushers and rolls, and the fiber is separated by screening into the following grades:

No. 1 - 3/4-inch long and longer.
No. 2 - 3/8 to 3/4 inch.
No. 3 - 1/8 to 3/8 inch.
No. 4 - less than 1/8 inch long.

Filter fiber consists of grades 3 and 4, further processed; grades 1 and 2 are classed as spinning fibers.

In the United States and Canada the material that is fiberized is graded according to the Canadian classification, determined by tests made with the Quebec Standard testing machine. This machine consists of 3 screens (1/2-inch mesh, 4-mesh, and 10-mesh) and a box for the shortest material. The 4-figure designation of the grade indicates the number of ounces from a total of 16 that is retained in each of the 4 receptacles. Thus, a fiber designated 2-8-4-2 signifies that, of the 16 ounces, 2 remained on the top screen, 8 on the second, and 4 on the third and 2 were in the box.

The standard grades of mill fibers (machine-processed) are shown in table 2.

Amphibole asbestos produced in California has been used as a filler in plastics, in fiberboard, in cement products, in floor tile, in plaster and stucco, in chemical acid-resistant fillers, in manufacturing automobile battery boxes, and in fire-resistant paint.

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TABLE 2. - Standard grade of machine-processed mill fibers

Standard designation of grades	Guaranteed minimum shipping test, Canadian standard testing machine	Chief uses
Group 3:		Spinning or textile fiber.
3F	7 - 7 - 1.5 - 0.5	
3K	4 - 7 - 4 - 1	
3R	2 - 8 - 4 - 2	
3T	1 - 9 - 4 - 2	
3Z	0 - 8 - 6 - 2	
Group 4:		Shingle fiber, asbestos-cement products, compressed sheet packing, etc.
4H	0 - 5 - 8 - 3	
4K	0 - 4 - 9 - 3	
4M	0 - 4 - 8 - 4	
4R	0 - 3 - 9 - 4	
4T	0 - 2 - 10 - 4	
4Z	0 - 1.5-9.5 - 5	
Group 5:		Paper stock, millboard, etc.
5D	0 - 0.5-10.5- 5	
5K	0 - 0 - 12 - 4	
5M	0 - 0 - 11 - 5	
5R	0 - 0 - 10 - 6	
Group 6: 6D	0 - 0 - 7 - 9	Waste, stucco, or plaster.
Group 7:		Shorts or refuse, asbestos boiler and roofing cements, roofing paints, asphalt floor tile, and occasionally millboard.
7D	0 - 0 - 5 - 11	
7F	0 - 0 - 4 - 12	
7H	0 - 0 - 3 - 13	
7K	0 - 0 - 2 - 14	
7M	0 - 0 - 1 - 15	
7R	0 - 0 - 0 - 16	
7T	0 - 0 - 0 - 16	
Group 8: 8S	Under 75 pounds per cu. ft. loose measure	Sand, asbestos, flooring, wall tile, etc.
Group 9: 9T	More than 75 pounds per cu. ft. loose measure	Gravel and stone asbestos flooring, wall tile, etc.

PRICES

The following average prices of asbestos for October 1956 have been taken from Markets - Trends and Prices, Engineering and Mining Journal, volume 157, November 1956, page 71:

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Asbestos f.o.b., Canada (Quebec mines)(U. S. funds),ton:			
Crude No. 1	$1,400	to	$1,725
Crude No. 2	750	to	1,100
Spinning fibers	350	to	650
Shingle fibers	190	to	210
Paper stock	114	to	137
Waste	82	to	84
Shorts	28	to	75
Asbestos, f.o.b., Vancouver, B. C. (U. S. funds):			
Spinning fiber	460	to	750
Shingle fiber, eff. Jan. 1..	205	to	300
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	353	to	383
Shingle stock	172	to	190
Paper stock	114	to	145
Waste, stucco, or plaster ..			82
Refuse or shorts	39	to	72

ALAMEDA COUNTY DEPOSITS

Outcrops of serpentine are distributed throughout the Berkeley Hills and in the hills south of the Livermore Valley.

A limited tonnage of short-fiber asbestos was mined from a small deposit in the N1/2 sec. 36, T. 1 S., R. 3 W., in 1915 and 1918 (14, p. 285). The fiber was mixed with magnesite and used by the John D. Hoff Asbestos Co. in manufacturing asbestos stucco, flooring, and steam-pipe covering. No production of asbestos has been recorded since 1918.

AMADOR COUNTY DEPOSITS

Both amphibole and chrysotile asbestos occur in or near massive serpentine bodies that outcrop in the western part of the county and extend from the south to the north boundaries. Ten tons of asbestos valued at $1,000 was produced in 1908, and 2 tons valued at $200 was produced in 1909. There has been no recorded production since that time; however, intermittent development work on several prospects has continued.

Mace Ranch Prospect (20, p. 134)

This deposit is in the NE1/4 sec. 20, T. 6 N., R. 10 E., about 2-1/2 miles northeast of Ione. The asbestos occurs in irregular veins along the contact of serpentine and amphibolite. According to a field report by C. A. Waring, formerly of the California State Mining Bureau, this asbestos is of the amphibole variety and up to 12 inches long and occurs as slip fiber, with some crossfiber. He described it as low-grade, siliceous, and in small amount, as shown in the limited opencut prospecting work.

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George Thomas Prospect (11, p. 203)

This deposit is in sec. 34, T. 6 N., R. 11 E. In 1953 George Thomas of Jackson, Calif., was developing this amphibole prospect 1-1/2 miles southeast of Jackson. There is no record of production, and no detailed mineralogical evaluation of the deposit is available.

BUTTE COUNTY DEPOSITS

Small amounts of amphibole asbestos occur in the northwest-trending serpentine belts in the central and eastern portions of the county. In the Magalia district in 1947, John Quirk (27, p. 421), of Paradise, mined some tremolite from small lenses in serpentine.

CALAVERAS COUNTY DEPOSITS

A series of discontinuous sill-like bodies of serpentine crop out as long, narrow strips in the western end of Calaveras County. The serpentine trends northwesterly from the Stanislaus River across Calaveras County into the western end of Amador County. Occurrences of both chrysotile and amphibole asbestos have been found in some bodies of serpentine, and one large deposit of good-quality chrysotile asbestos.

American Asbestos Mining Corp.

Location and Accessibility

The property of the American Asbestos Mining Corp. (18, pp. 163-164; 24, pp. 226-227) is in secs. 15 and 16, T. 1 N., R. 13 E., Calaveras County, in the low foothills that border the Sierra Nevada Mountains on the west. Figure 3 shows the general location of the property.

To reach the property from Angels Camp, follow State Highway 49 - a paved highway - northwesterly 1 mile to Altaville. Turn left, and follow paved State Highway 4 southwesterly 12 miles to Copperopolis. From Copperopolis, follow the paved, southeasterly trending road to O'Byrnes Ferry 1.5 miles, at which point turn left, and follow a poor dirt road southeasterly 5.5 miles to the property, which is situated on a low hill northwest of the Stanislaus River about 1.5 miles west of the Melones Dam.

Property and Ownership

The property holdings comprise 280 acres that were first worked about 1904 and more vigorously during and after World War I until 1923. Equipment included a crusher, hammermill, and compressor. Considerable core drilling was done by the Johns-Manville Co. on the property during 1944-45, but records are not available relative to the drilling program.

Following this drilling program, the property was inactive until the owners, Carl Abbott, Granville Abbott, Ruth Ebey Frye, and the Central Bank

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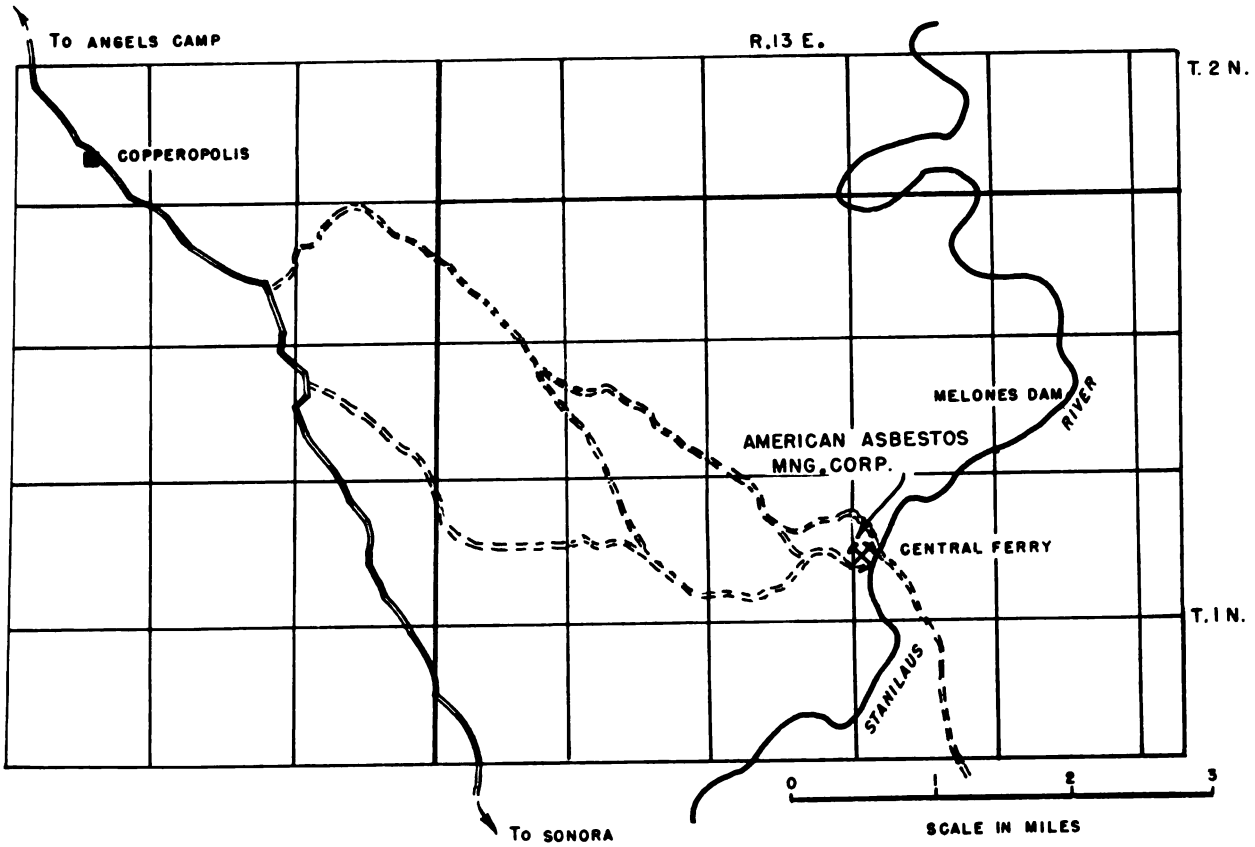

FIGURE 3. - Index Map Showing Location of American Asbestos Mining Corp. Mine, Calaveras County.

as trustee for Laura C. Fitzgerald, Clarence E. Vorhees, and Florence E. Vorhees, his wife, and the Asbestos Producing Co. of California leased the property in October 1953 to the American Asbestos Mining Corp., 11 West 42d Street, New York, N. Y.

The company obtained a 33-ton sample in 1955 for metallurgical testing. The tests were made in an asbestos plant at Globe, Ariz., and the amount and grade of asbestos were determined.

Geology and Ore Deposits

Rocks in the area comprise a thick belt of ultrabasic intrusives of the peridotite type, which have been extensively altered to serpentine. This belt extends northwest-southeast. On the east it contacts amphibolite schists and slates and on the west and south older crystalline rocks. The property of the American Asbestos Mining Corp. lies within this belt of serpentine.

Surface exposures indicate an asbestos-bearing zone, 1,800 feet long and 400 to 500 feet wide. It occurs possibly as an elongated sill that strikes N. 70° W. and dips east. In this area the serpentine is completely folded and in places broken by small faults that more or less parallel the folding. The

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ore is chiefly serpentine, in which stringers and seams of crossfiber chrysotile occur. The fiber ranges up to 1 inch in length and appears to be of good quality.

The work to date indicates a deposit of chrysotile asbestos of considerable size that can be worked by open-pit methods.

Description of Property

The northwestern portion of the deposit has been developed by considerable bulldozer work, by an adit containing about 250 feet of workings, and by a 30-foot shaft about 450 feet south of the adit. Approximately 150 feet northeast of the above adit is a second adit containing about 110 feet of workings. This latter adit contains only traces of asbestos and is apparently outside of the mineralized zone.

About 1,200 feet southeasterly of the above workings are 2 adits, consisting of 290 and 110 feet of workings, respectively, inside the mineralized zone.

In addition to the above, there are about a dozen surface trenches. The lower or southeastern portion of the deposit is in a harder serpentine with a lower asbestos content than the upper or northwestern part.

The diamond-drilling program of the Johns-Manville Co. explored approximately 1,800 feet of the deposit along its strike.

Turner and Lloyd Prospect

This prospect (18, p. 164) is probably in T. 2 N., R. 11 E., about 3/4 mile southeast of the old Nassau copper mine and 1/4 mile from the Copperopolis-Angels Camp road 9 miles from Angels Camp, or 3-1/2 miles north of Copperopolis. There are 80 acres, on which good prospects of short-fiber chrysotile asbestos have been found in a number of places. Only assessment work has been done on the property, which is owned by Dr. H. C. Turner and Jarvis Lloyd of San Andreas.

Nuland and Nuner Prospects

These prospects (24, p. 227) are in secs. 7 and 8, T. 4 N., R. 12 E., approximately 1 mile north of San Andreas. Asbestos is said to occur in serpentine on these ranch properties, which are owned by Mrs. J. Nuland and Mrs. Nellie Nuner. No attempt has been made to operate these prospects.

Unnamed Occurrences

A

This occurrence of asbestos is in the SW1/4 sec. 1, T. 3 N., R. 13 E. (12, p. 17). Thin slip-fiber veins and veinlets of amphibole asbestos, probably tremolite or actinolite, are in the ultramafic masses but are too small to have economic interest. The largest amphibole vein observed is approximately

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1 foot thick and has been explored by a short adit. Fibers of the amphibole nearly parallel the walls, and the length of the fibers is not related to the thickness of the seam. In hand specimens the apparent length of the fiber is commonly more than 2 inches.

B

This occurrence of asbestos is in the NE1/4 sec. 2, T. 4 N., R. 13 E. (12, p. 17). Chrysotile veinlets with a maximum thickness of about 1 mm. are present in serpentine in a small area on the northeast side of a ridge, 2 miles east of El Dorado. No work has been done on these occurrences of asbestos.

CONTRA COSTA COUNTY DEPOSITS

Ultramafic rocks are exposed in two areas of Contra Costa County, one in the western part of the county and the other centrally located in the vicinity of Mount Diablo. In 1915, 80 tons of asbestos from Placer, Alameda, and Contra Costa Counties was sold at an average price of $20 a ton.

A. Drumeller (17, p. 7) located some claims in 1925 on an asbestos deposit in T. 1 N., R. 1 E. It is said to be 8 miles easterly from Clayton and is in the so-called Diablo mining district. The property has no production record.

EL DORADO COUNTY DEPOSITS

Serpentine areas in which chrysotile asbestos might occur extend north and south for 6 miles and are 2 miles east of Georgetown.

Between 1904 and 1906 a total production of 142 tons of asbestos was reported from this county. Part of this production came from the property of the El Dorado Copper Co. (22, p. 207) situated about 2-1/2 miles southeast of Georgetown in sec. 24, T. 12 N., R. 10 E.; the French Hill claim, about 2 miles north of Greenwood and near the American Canyon, in sec. 36, T. 13 N., R. 9 E., was also listed as an asbestos property, but no details of its output are available. There is no record of any later activity in prospecting for asbestos.

LAKE COUNTY DEPOSITS

Franciscan sediments predominate in Lake County. They have been intruded by large dikes of ultrabasic rocks, now altered to serpentine. North of Middletown a deposit containing fibrous chrysotile occurs in the serpentine.

Copsey and Jones Prospect

This prospect is in T. 12 N., R. 7 W.; it is owned by Arthur Copsey (7, p. 17) of Middletown and Herbert Jones. The property is about 1-1/2 miles south of Howard Springs about 10 miles north of Middletown via the Big Canyon road. The Johns-Manville Co. is said to have done a few hundred feet of

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development work on the deposit and to have taken out 7 to 8 tons of asbestos early in 1928.

NAPA COUNTY DEPOSITS

The serpentine rocks of the northern coast ranges, some of which occur in Napa County, are logical areas for asbestos prospecting; however, only one deposit has been developed in Napa County.

Tabor Mining Co.

Location and Accessibility

The Tabor Mining Co. property is at the top of one of the low, grassy knobs that form the Napa Hills. It is situated in the SE1/4 sec. 4, and SW1/4 sec. 3, T. 7 N., R. 3 W. From a point on Highway 37, about 18 miles northeast of Napa or 8-1/2 miles southwest of Monticello, an access road leads westward 1.6 miles to the property. The mine is at an elevation of around 800 feet.

Property and Ownership

The property consists of approximately 252 acres. Twelve claims have been patented. The property and mill were purchased in 1955 by Patrick M. Tabor of Napa, Calif.

History

The deposit was discovered in 1907 or 1908 and is said to be the first recorded occurrence of asbestos in Napa County. Before 1929 the property was owned by Jas. S. Brogan of San Francisco and R. R. Norton of Berkeley and was known as the Napa asbestos quarries (1, p. 216; 8, p. 419). In the early 1930's, Kohler and Chase (13, pp. 163 and 168), 26 O'Farrell Street, San Francisco, Calif., acquired the property, at that time known as the Monticello Asbestos mine. They constructed a mill at the mine in 1942. Mining was by open-pit methods, and production continued until 1945. The mill product was marketed under the trade name "Plastene" and was used in plaster and stucco for fireproof construction.

Patrick M. Tabor of Napa, Calif., purchased the property and the partly dismantled mill in 1955 and changed the name of the property to the Tabor Mining Co. This company is mining loose, unconsolidated material by power shovel and recovering the asbestos in a mill on the property. A fair production of low-grade asbestos was produced in 1955 and 1956. The mill product is marketed as an ingredient for concrete.

Geology and Ore Deposits

The hills forming the low range northeast of Napa are formed of Jurassic sediments that have been intruded by a mass of basic igneous rock. This intrusion has been altered to serpentine at the Monticello mine. In the serpentine, thin seams of crossfiber chrysotile occur, sometimes reticulated, sometimes in

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parallel bands. The seams range from 1/2 inch to knifeblade thickness, the average being about 1/8 inch. Distribution of chrysotile throughout the serpentine body is not uniform, and some areas contain little or no visible fiber. Toward the southern end of the property, smooth slippage surfaces are very noticeable. Elsewhere, the rock breaks with rough, uneven fractures. The best ore appears to be in the serpentine with rough fractures.

Short-fiber chrysotile asbestos is disseminated throughout a body of serpentine that outcrops prominently for a length of at least 1,500 feet and a width of 300 feet. Erosion has exposed the ore on the west side for a vertical distance of about 200 feet. The general strike of the lens of serpentine is NW.-SE.

The results of analyses of separate samples of chrysotile from the property, made by different laboratories, are provided in table 3.

TABLE 3. - Results of analyses of two separate samples of chrysotile, Tabor Mining Co., Napa County, Calif.

	Sample 1	Sample 2
Silica	38.49	37.36
Magnesia	37.00	38.00
Combined water	15.91	13.07
Uncombined water	2.09	1.21
Iron oxide	2.88	6.56
Alumina	3.17	3.68
Lime	.28	Nil.
Alkalies	.27	Nil.
Total	100.09	99.88

The material has been used for manufacturing insulation for housing units by impregnating a layer of wood pulp with asbestos fiber; manufacturing concrete pipe in which inclusion of asbestos reduces the permeability of the concrete; with cement as a finishing plaster on outside and inside walls of buildings, giving a tougher surface resistant to moisture, and as a heat insulation; with cement as an acid-resistant covering for floors and walls; as a constituent of flux coating on welding rods; and in manufacturing fireproof, heat-resistant wallboard.

Description of Property

An adit has been driven 320 feet into the hill at the level of the mill. A raise has been driven to the surface at the end of the adit. About 400 feet of additional work has been done in driving crosscuts, drifts, raises, and other short adits at various other points on the hill. Serpentine is sometimes a difficult and dangerous rock to mine when wet; the owners are not extending the existing development work and plan to mine by open-pit methods, thus reducing cost of maintenance of workings and risk of accidents. A sketch of the plan of the mine workings is shown in figure 4.

The property apparently contains a large tonnage of commercial ore.

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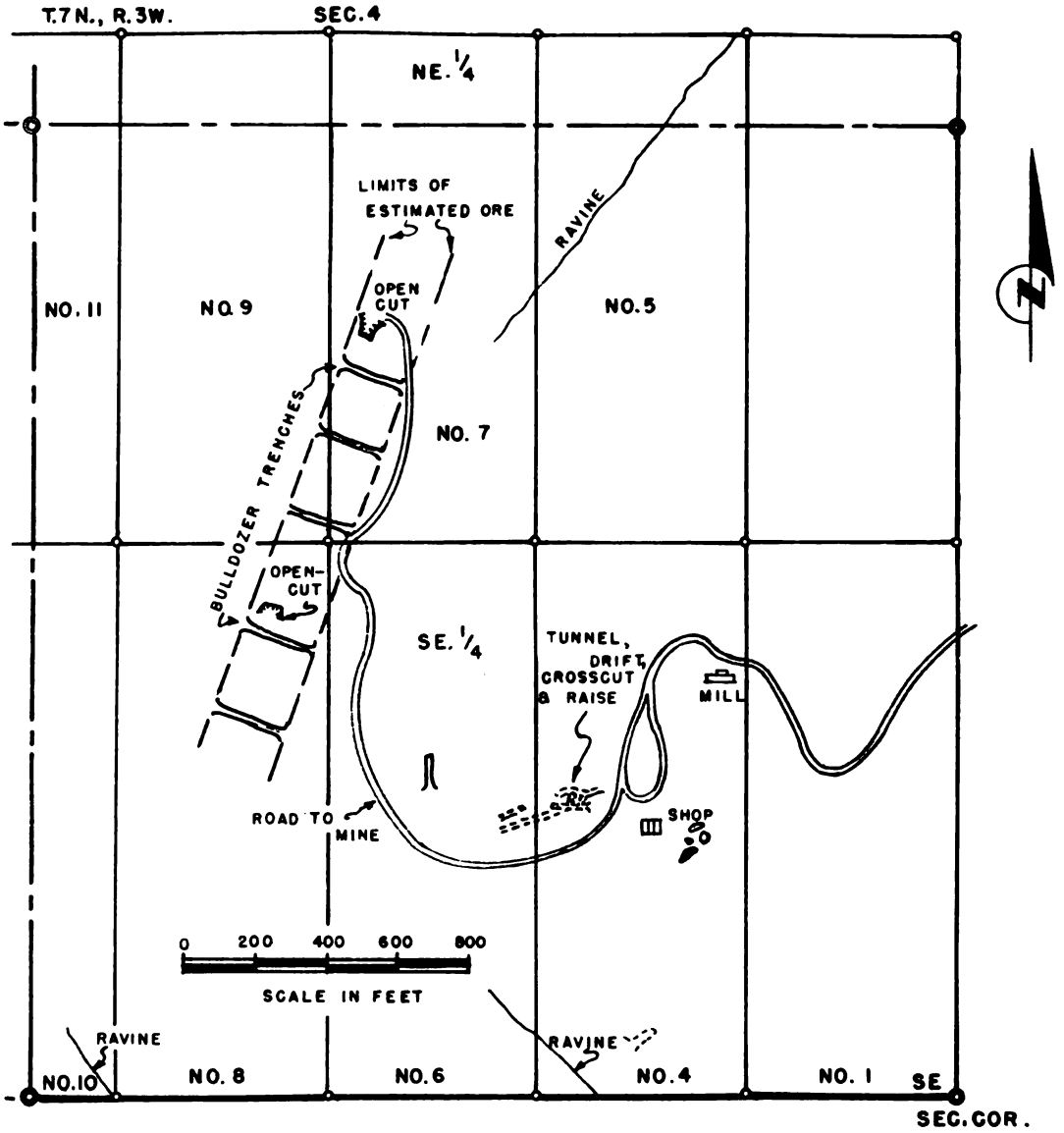

FIGURE 4. - Plan of Mine Workings, Monticello Mine, Tabor Mining Co., Napa County.

Mill

During operation of the property by Kohler and Chase a 40-ton mill was installed at the mine.

Crude ore was trucked around the hill about 0.6 mile to the electrically operated mill. The ore was dumped on a grizzly with 3-inch openings and fed to a jaw crusher for coarse crushing. The minus-1-inch product was discharged into a countercurrent drier. A cyclone air separator removed the fibers, which were screened and graded on a 4- by 8-foot, eccentric, head-mounted, shaking screen. A D-18 disintegrator and a D-12 disintegrator made additional separations of fiber. The disintegrators were also connected with cyclone air

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separators and shaking screens. The end products were passed to a bagging machine, where the pulverized asbestos was put up in 100-pound paper bags. Operations ceased in 1945, and the mill machinery was partly dismantled.

After the Tabor Mining Co. assumed operation of the property, the partly dismantled mill was reconstructed. The flowsheet is shown in figure 5. The company is now producing 12 sacks a day of a chrysotile-asbestos product, which carries no trade name; it consists of fibers 1/8 inch in length down to 30-mesh.

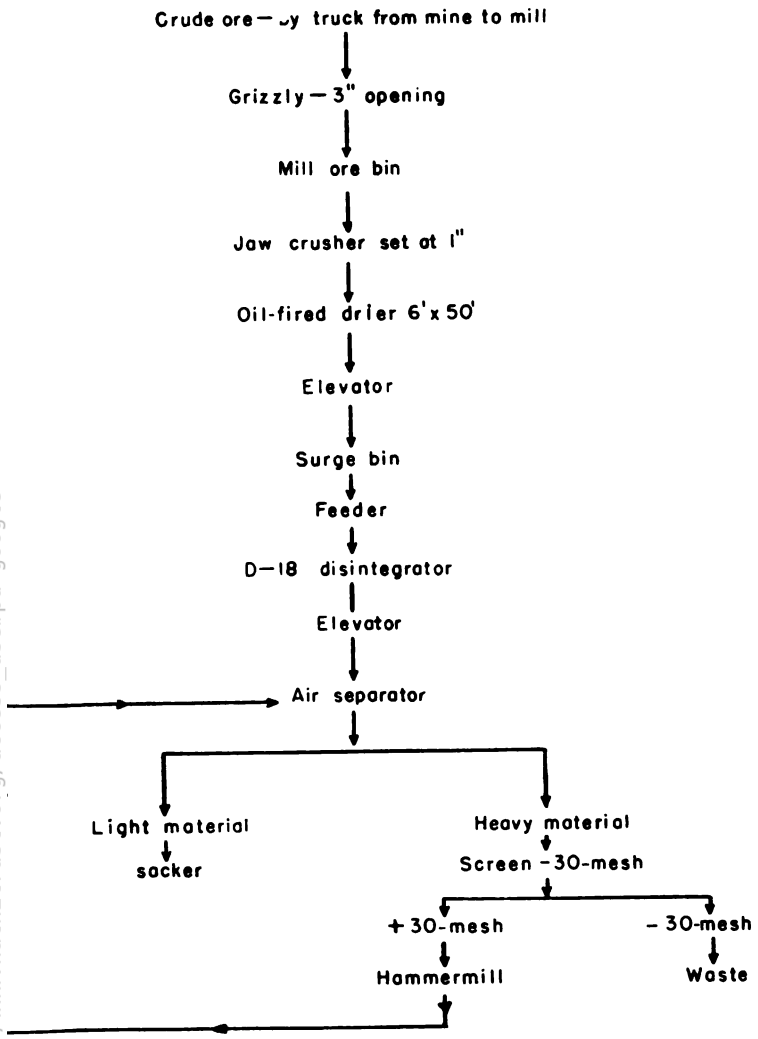

FIGURE 5. Flowsheet of Tabor Mining Co. Mill, Napa County.

NEVADA COUNTY DEPOSITS

The western half of Nevada County contains three belts of northerly trending ultramafic rocks. Chrysotile-asbestos deposits occur in serpentine in the eastern belt in the vicinity of Washington. Nevada County had a recorded production of asbestos from 1917 through 1923.

Stark Asbestos Deposit

Location and Accessibility

The Stark asbestos deposit is situated in the Washington mining district, secs. 2, 11, and 12, T. 17 N., R. 10 E., Nevada County, Calif. The deposit can be reached from Nevada City by traveling State Highway 20 for 13 miles eastward to the Washington turnoff; then proceeding by surfaced road for 5 miles to the village of Washington; then continuing about 2-1/2 miles by a forest and logging road westward along the north side of the South Fork of the Yuba River to the property. The general location of the deposit is shown in figure 6. Emigrant Gap, 20 miles by paved roads east of Washington on the Southern Pacific Railroad, is the nearest rail point. Electric power is available within 6 miles of the property. The property is on the north side of the valley of the South Fork of the Yuba River, and extends northward up the slope of the valley for almost 4,500 feet, rising 1,500 feet in that distance.

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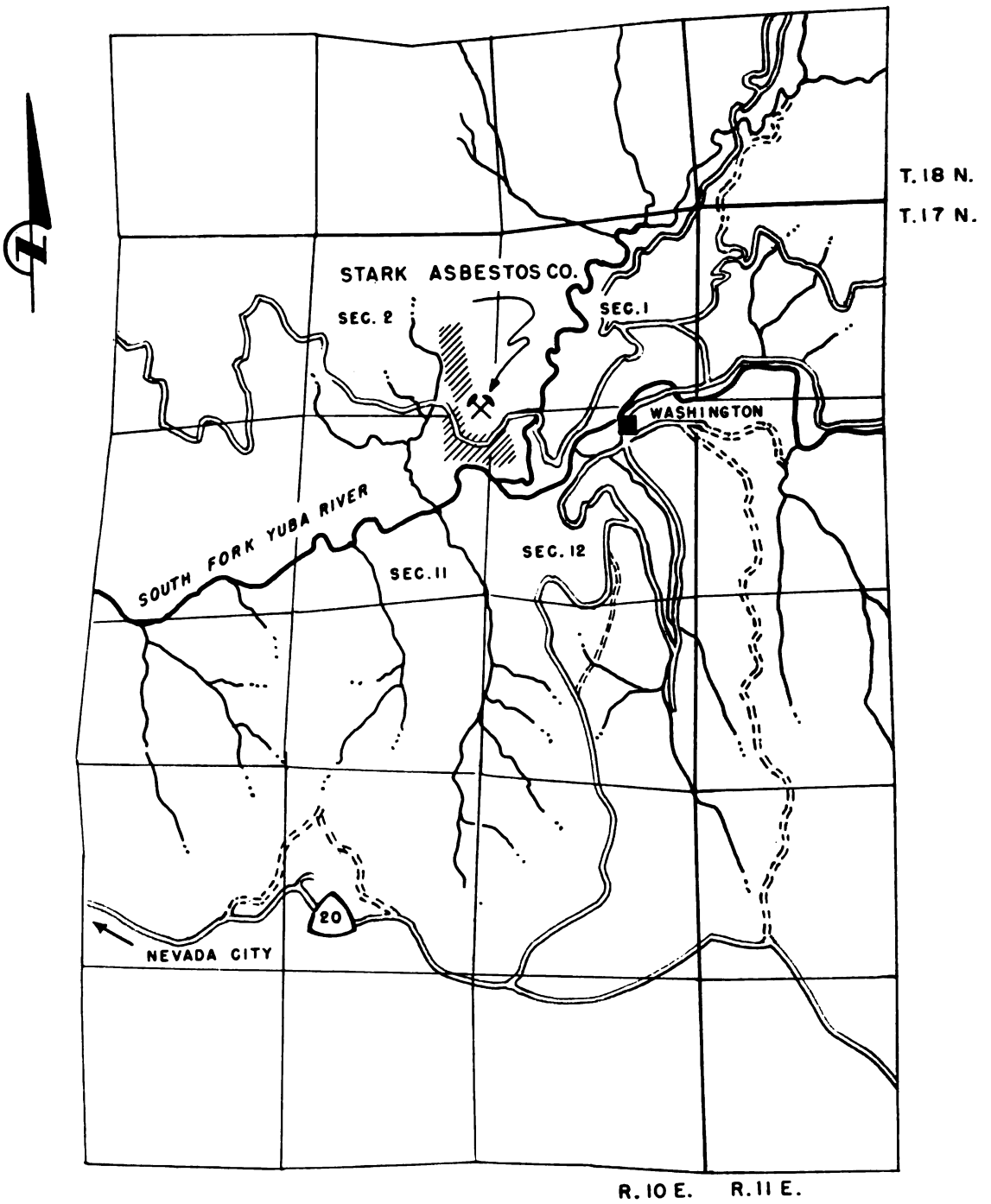

FIGURE 6. - Index Map Showing Location of Stark Asbestos Deposit, Nevada County.

History

The presence of asbestos on the claims was known before the First World War. Between 1917 and 1923 the Sierra Asbestos Co. (24, p. 378) leased the property and mined and milled about 8,000 tons of rock, most of which came

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from a gloryhole at the south end of the Lent claim. The product was short-fiber, chrysotile asbestos, very little of it was 1 inch or more long. At first an old 20-stamp mill fitted with air suction and fiberizing machinery was used. Later, 42-inch rolls were installed, but no regular production was made. Only annual assessment work was done after this period. In 1951 the Philip Carey Co., which had a lease, surveyed, trenched, and core-drilled portions of the property.

Property and Ownership

The property consists of the Cotton King, Lent, Victory, and Asbestos Quartz No. 1 lode claims and real estate described as NE1/4 NE1/4 sec. 11, T. 17 N., R. 10 E., M.D.B. & M. It is owned by Dr. J. H. Stark and Frank F. Smith of Oakland, Calif., and Judge James Smell of Nevada City.

Geology and Ore Deposits

The Stark asbestos deposits occur along the west border of a northerly trending ultrabasic intrusion of Jurassic age that intrudes marine metasediments of Mississippian age. This ultrabasic intrusion has an exposed length and maximum width of about 5 and 1-1/2 miles, respectively. It contacts steeply dipping, dark-gray slates on the east and a narrow band of quartz hornfels, dipping about 70° eastward, on the west. The southern portion of the intrusive has been altered to light-green schistose serpentine, and the northern part is unserpentinized pyroxenite, bordered by serpentine. The intrusive disappears under andesite to the north and also to the south.

The asbestos deposits are parallel in strike and dip to the west contact of the intrusive. Only in 2 zones, 1 to the north and 1 to the south, are there concentrations of importance. The southern zone outcrops on the Asbestos Quartz No. 1 claim between the Yuba River and the Forest Service road and has an exposed length and width of 500 and 250 feet, respectively. It is approximately 300 feet from the west contact of the intrusive. It is widest at the extreme southern end and diminishes in width and in asbestos content to the north. The serpentine between the north and south zones contains only small amounts of asbestos. The northern zone extends from a point about 1,200 feet northwest of the southern zone on the Lent claim, west of north for 2,000 feet. Its trend is along the west contact of the intrusive and has an average width of approximately 150 feet.

The asbestos occurs as veins of chrysotile of the crossfiber variety. The length of the fiber varies between 1/32 and 7/16 inch; the majority of the fiber will average less than 3/16 inch. The northern zone has an approximate asbestos content of 5 percent, and the southern zone probably 7 percent.

Core drilling of the north zone revealed the existence of a fault that follows the serpentine hornfels contact; along the fault is a zone of fault gouge 3 feet wide.

With assistance from the Defense Minerals Administration, 2,680 feet of diamond drilling was done in the north zone during 1951 by the Philip Carey Manufacturing Co. No recent activity has been reported.

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Description of Property

The lower or southern zone has been developed by a crosscut trench several hundred feet long and by a 270-foot adit near the river.

Development openings in the upper or northern zone consist of 2 adits (each about 115 feet long), a small quarry (50 feet long, 20 feet wide, and 15 feet deep), and a gloryhole (150 feet in diameter and 75 feet deep). In 1951, 110 feet of trenching through the overburden and 2,680 feet of diamond drilling in 10 holes were done in the upper deposit.

A sketch of the plan and section of the asbestos deposit is shown in figure 7.

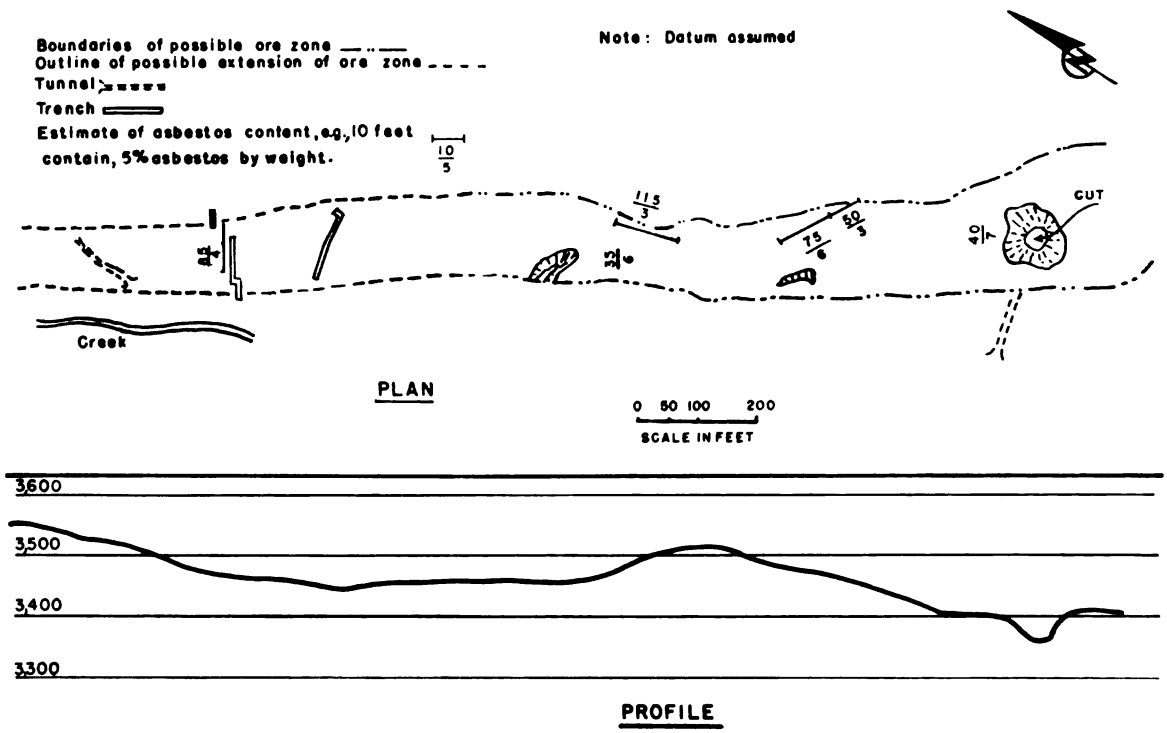

FIGURE 7. - Sketch of Plan and Section, Stark Asbestos Deposit, Nevada County. *(From Philip Carey Mfg. Co. Map.)*

PLACER COUNTY DEPOSITS

Three parallel belts of ultramafic rocks and serpentine trend northward across the central part of Placer County. The most eastern belt is the largest in area and is known as the "great serpentine belt." It extends from the Middle Fork of the American River northward several miles beyond the North Fork of the American River. Two deposits of slip-fiber tremolite asbestos have a recorded production. One of the deposits is still producing a small quantity of tremolite asbestos.

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Morgan Deposits

Location and Accessibility

The Morgan (31, p. 51) property is in the southern part of sec. 1, T. 15 N., R. 10 E., on the north slope of the canyon of the American River. To reach it, turn left off U. S. Highway 40, 0.9 mile west of Baxter, Calif., a short distance beyond the Southern Pacific Railroad overpass. Follow a dirt road toward Moody Ridge 0.9 mile to the intersection of roads marked "Lovers Leap-Moody Ridge." At this intersection follow the left road 0.1 mile, continue on foot about 0.4 mile to its terminus, then follow a rather precipitous trail about 1 mile down the mountainside toward the North Fork of the American River to the property. A sign on the trail at the property is marked "Morgan asbestos mine."

Property and Ownership

This property was developed by the Morgan Asbestos Mining & Manufacturing Co. during the period 1905 through 1913. Thereafter, only assessment work was done on the property. A reported production of 70 tons of asbestos was made in 1908. In 1950 the owner was Edmond Thomas Dooley of 85 Southern Heights Boulevard, San Rafael, Calif.

Geology

In the vicinity of the property, a large north-south-trending body of serpentine 1 to 3 miles in width is well exposed in the 1,000-foot-deep canyon of the North Fork of the American River. The asbestos deposits lie on the steep north slope of the mass of serpentine. Small veins of short crossfiber chrysotile and irregular sheets of strong flexible slip-fiber tremolite have been found in the serpentine, but they were distributed too sparsely to be mined profitably. Exploration by tunnels failed to disclose asbestos of economic importance. Most of the asbestos was of the slip-fiber type.

Description of Property

Remnants of small dumps are the only evidence of the existence of old underground workings. The present owner reports that old workings consisted of three adits whose portals are caved and hidden by slides. The adits are on the same ridge, in close proximity to each other. The size of dumps at present appears too small for mine adits of the above length; however, the dumps are about 50 years old, and most of the material could have been washed away.

Iowa Hill Deposits

W. Zimdars and J. Delmue, 365 Foresthill Ave., Auburn, Calif., are operating on a small scale a deposit of slip-fiber tremolite asbestos about 1 mile east of Iowa Hill. The property was first operated many years ago by the Sprague-Keasby Asbestos and Magnesia Co. (31, pp. 51-52) and later by Placer County Properties Co.

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The deposits are in secs. 28 and 33, T. 15 N., R. 10 E. They adjoin the Morning Star gold mine on the southeast.

The fiber occurs in a faulted contact zone associated with amphibolite schist in old hydraulic mine workings. The vein is about 6 feet wide and strikes N. 60° W. Asbestos fiber was visible along a strike length of 150 feet. Fibers 8 inches long have been reported.

A production of 35 tons before 1948 has been reported. This property was worked by Zimdars & Delmue from 1953 to 1956. A few tons of tremolite asbestos was produced for acid filtering purposes. The property was sold to L. L. Anderson in 1956.

SHASTA COUNTY DEPOSITS

Good-quality chrysotile and amphibole asbestos have been known for years in the serpentine rock in the northwestern corner of Shasta County. The deposits are 3 to 7 miles north and northwest of Sims. Development has been slow, and only a little production has been recorded.

The Blas Corp.

Location and Accessibility

The property of the Blas Corp. (28, p. 369) consists of eight claims in sec. 20, T. 37 N., R. 5 W., Shasta County.

It is accessible from the highway maintenance station at Gibson, which is 36 miles north of Redding on U. S. Highway 99, by going north 0.7 mile on U. S. 99 and then turning left and following the Highland Lake Road north of Boulder Creek 7.5 miles west to a fork; at this point the left fork is followed 0.8 mile to the property. The claims are near the head of Boulder Creek at an elevation of about 5,000 feet.

Property and Ownership

The property consists of the Princess, Nos. 1, 3, 4, 5, 6, 8, and 9, and Asbestos Empress claims. It is also known as the Andreatta and Boito asbestos property. The claims are held by the Blas Corp., 919 Michigan Ave., San Jose, Calif. The company has requested a patent covering the above claims.

Geology and Ore Deposits

Chrysotile asbestos occurs in the outcrops of serpentine and peridotite. The deposits are lenticular, and the asbestos content probably will average 4 to 5 percent of the rock mass. Fiber 1/8 to 1/2 inch long is exposed in surface trenches. In the upper trench the asbestos seams strike N. 85° W. and dip steeply southward. This trench appears to contain 2 narrow zones of asbestos within a 50-foot zone. The zones carry considerable chrysotile asbestos, mostly 1/4 to 1/20 inch long. North of the upper trench and at about the same elevation a second trench exposes an asbestos zone 20 feet wide that

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contains fiber of good length. A third trench about 300 feet farther east and 100 feet lower in elevation shows a small amount of asbestos in narrow veins.

In August 1950 the Johns-Manville Co. obtained an option on the property. It conducted exploratory work consisting of bulldozer trenching and about 2,000 feet of diamond drilling. There is no record of further development or production.

Description of Property

The principal workings consist of 3 trenches bearing northwest and which are 200 to 250 feet long, 20 to 50 feet wide, and 6 to 12 feet deep. The trenches are spaced about 150 feet apart along the strike of the deposits.

Stock Property

Location and Accessibility

The Stock property (4, p. 113; 19, pp. 128-129; 26, pp. 354-355) consists of patented land in secs. 1, 2, 3, and 4, T. 37 N., R. 5 W., and secs. 33 and 34, T. 38 N., R. 5 W., and also unpatented claims in T. 37 N., R. 5 W., Shasta County, at elevations of 3,500 to 6,300 feet. Mears Creek flows through the property.

It is accessible by going north on U. S. Highway 99, 44 miles from Redding, or by going south from Dunsmuir 12 miles, then turning west on the Mears Ridge road (north side of Mears Creek) and following this road westerly 5.2 miles to the Sylvester amphibole-asbestos mine. From this point a 2-mile-long trail leads up Mears Creek to the property, which adjoins the Sylvester property on the north and west.

Property and Ownership

The property includes 1,023 acres of patented land and 17 unpatented claims containing 340 acres. It is owned by the heirs of the Sarah I. Stock estate. Mrs. Bryant, Bellflower, Calif., one of the heirs, is agent for the estate. It is leased to Loma Blanca Mines, Inc., Homer E. Fenn, president, Dunsmuir, Calif.

Geology and Ore Deposits

The country rock is principally serpentine, with later dikes of diorite and gneiss. Extensive outcrops of chrysotile-bearing rock occur, and a small amount of work has been done on them. Amphibole asbestos occurs in small lenses and pockets in the serpentine.

Description of Property

The property is in the prospect stage, and only a small amount of work, consisting of prospect cuts, has been done. A minor amount of asbestos had been produced from the property before 1945.

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Sylvester Amphibole-Asbestos Mine

Location and Accessibility

The Sylvester amphibole-asbestos deposit (26, p. 355) is on the southern slope of Mears Ridge, in the NW1/4 sec. 1, T. 37 N., R.5 W., and sec. 36, T. 38 N., R. 5 W., Shasta County, Calif.

It can be reached by automobile by going north on U. S. Highway 99, 44 miles from Redding, or by going south from Dunsmuir 12 miles, then turning west on the Mears Ridge road (north side of Mears Creek) and following this road westerly 5.2 miles. The road, although steep, is in good condition.

Property and Ownership

The property consists of approximately 41.4 acres in sec. 1 owned by the Southern Pacific Land Co. and 4 claims in sec. 36 held by location by Ray J. Sylvester of Weed, Calif. Sylvester leases the land in sec. 1 from the Southern Pacific Land Co.

Geology and Ore Deposits

The asbestos deposits are situated on the abruptly rising southern slope of the mountain. They occur in shear zones in massive serpentine that strike west and dip steeply northward.

The asbestos is the slip-fiber amphibole type known as anthophyllite, colored brown, white, and green. It appears to be clean and free from rock or gritty particles.

Description of Property

The mine workings consist of 4 adits, 3 of which are caved, and a surface cut. One adit, now inaccessible, in the lower part of the property, is reported to be 30 feet long. The portal is at about the same elevation and about 200 feet northeasterly of a cabin on the property. About 300 feet west and probably 150 feet above the cabin elevation, 3 more adits have been driven. One was driven N. 25° W. about 45 feet. It contained a small amount of amphibole asbestos on the right side about 10 feet from the portal. Another adit was started about 12 feet farther west and has been driven 130 feet. It intersected the caved end of the 45-foot adit. About 35 feet from the portal a stope 30 feet long extends 10 feet below and 20 feet above the floor. Asbestos has been mined from this stope since 1955. Some production is also from a 6-inch vein disclosed in a surface cut 20 feet west of the adit.

An old adit, now caved, a little farther west and about 50 feet higher, is on the same vein as the one being mined. Some production was obtained from this property by the Loma Blanca Mine, Inc., before 1955. Sylvester is now producing a long, white amphibole fiber that is being used in manufacturing fire-retarding paint.

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SIERRA COUNTY DEPOSITS

The western part of Sierra County contains numerous long, narrow sill-like masses of ultramafic rocks and serpentine. The county has no recorded asbestos production. A small number of asbestos prospects had been located before 1941.

W. W. Casserly Prospect

The W. W. Casserly prospect (6, p. 14; 21, pp. 154-155) consists of 2 claims near Goodyear's Creek about 1 mile from Goodyear's Bar. Slip-fiber amphibole asbestos occurs in the border of a large serpentine dike. Only assessment work has been done.

Lloyd and Milward Prospect

In 1940 Carl L. Lloyd (6, p. 14),498 25th St., Oakland, and M. S. Milward, Sierra City, held 12 claims on asbestos prospects in sec. 30, T. 21 N., R. 12 E.; secs. 33 and 34, T. 20 N., R. 12 E.; and secs. 3 and 4, T. 19 N., R. 12 E. This prospect is mostly in sec. 33, T. 20 N., R. 13 E., 1/2 to 1-1/2 miles south of Sierra City by trail.

Long slip-fiber amphibole asbestos occurs in schist and serpentine. Only assessment work has been done.

SISKIYOU COUNTY DEPOSITS

Many large masses of ultramafic rocks and serpentine are widely distributed throughout the western part of Siskiyou County. Some of the more accessible serpentine areas contain asbestos prospects of possible economic value. Many remote areas in the county have not been thoroughly prospected. The majority of the known asbestos prospects lie in serpentine areas in the mountains adjacent to the county highway between Yreka and Fort Jones and areas near Dunsmuir, Mount Shasta, Weed, and Gazelle.

A small asbestos production was reported in 1953 and 1954.

Mount Eddy Deposits

Location and Accessibility

The Mount Eddy deposit lies at an elevation of about 5,000 feet on the steep southeastern slope of a tributary valley to Eddy Creek, approximately in the center of sec. 19, T. 41 N., R. 5 W., Siskiyou County. Slopes in the immediate vicinity of the prospect are steep and rugged. The deposit is about 5 miles (air) S. 50° W. of the junction of U. S. Highways 99 and 97 in the town of Weed; its location is shown in figure 8.

To reach the mine from the city hall near the center of Mount Shasta, go 5.6 miles northward on U. S. Highway 99, then turn left on the first road (which is a few hundred feet beyond the Southern Pacific Railroad overpass), and continue 5 miles to the stockpile of the mine. About 1 mile beyond (northwesterly) the stockpile, the mine access road branches off on the left

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(southwest) side of the main graveled road and continues about 2.5 miles to the mine. The mine access road is generally passable only by jeep or similar car.

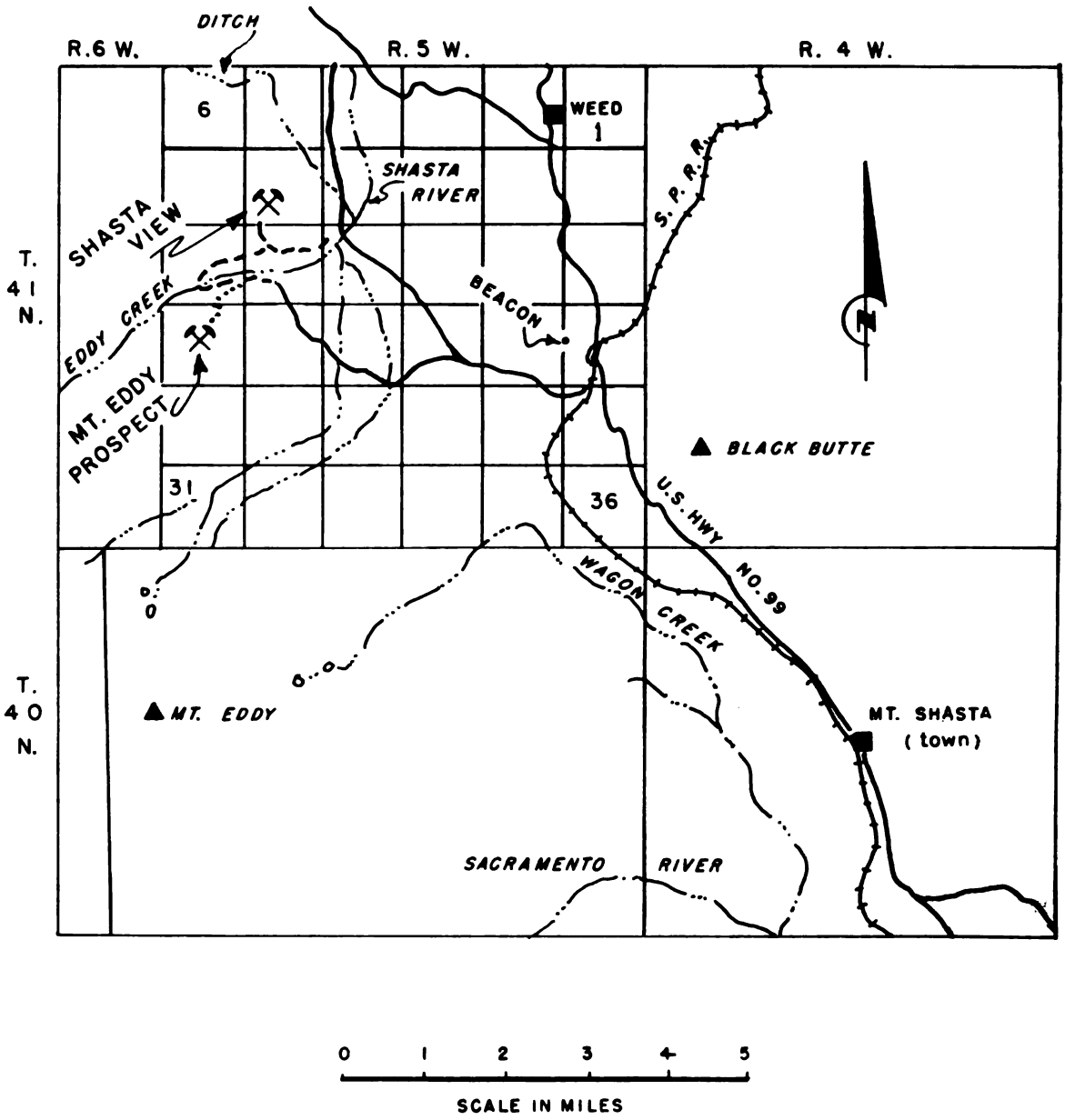

FIGURE 8. - Index Map Showing Location of Mount Eddy and Shasta View Asbestos Deposits, Siskiyou County.

Property and Ownership

The Mount Eddy deposit is on patented ground owned by the Ralph Smith Lumber Co., Anderson, Calif. Mount Shasta Mining Co., c/o Al Radero, P. O. Box 944, Mount Shasta, Calif., has a lease on the deposit.

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Geology and Ore Deposits

The Mount Eddy asbestos locality is near the northeastern edge of a large complex of ultramafic (dunite, peridotite, pyroxenite, serpentinite), and gabbroic, stocklike bodies of igneous rocks. As depicted on the geologic map of California (1938), the complex is regularly oval in plan and underlies an area of about 1,500 square miles. The gabbroic and ultramafic rocks are said to intrude Precambrian and Paleozoic metasedimentary rocks. The asbestos locality lies in the northernmost stocklike body of ultramafic rock in the complex. Dunite, peridotite, and pyroxenite are exposed discontinuously along the entire length of the access road between the stockpile and the mine.

The asbestos occurs in peridotite rather low in pyroxene and in slightly pyroxenic dunite, and there are a few small segregations of pyroxenite. The olivine groundmass in most places appears to be considerably serpentinized. The asbestos-bearing rock weathers light grayish green to pale buff. Much of the observed rock away from the prospect (dunite, pyroxenite, peridotite) weathers deep buff to reddish brown. The boundaries of the asbestos deposit are not exposed.

Chrysotile asbestos occurs in moderate to heavy concentrations throughout the outcrops. Nearly all the asbestos occurs as crossfiber in veins that range from 1/16 inch or less to as much as 1-1/2 inches in thickness. Veins 1/2 to 3/4 inch thick probably predominate, and many of these approach crudely planar form.

The most persistent attitude of the veins appears to be about vertical, with a strike of about north. In a few places "ribbon-fiber" asbestos, consisting of closely spaced, narrow, crossfiber veins 1/8 inch or less thick and about 1/8 to 1/4 inch apart, is predominant.

The percentage of asbestos in the rock varies throughout the deposit. In some places areas of outcrop as large as 50 square feet contain 15 to 25 percent asbestos. In the northernmost outcrop and in some other places the asbestos content is probably less than 5 percent. The average content is doubtless 5 to 10 percent. The fiber length ranges from less than 1/16 inch to 1-1/2 inches; the amount of exposed fiber longer than 3/8 inch is impressively large. However, many wider veins contain numerous partings and shears that would reduce the length of much of the fiber considerably. Commercial fabrication tests run on a small quantity of material from the deposit disclosed that the material was chiefly No. 2 crude, with small amounts of No. 1 crude and some material not quite No. 2. The probable existence of spinning grades of asbestos is indicated at the Mount Eddy prospect. A sketch of the Mount Eddy asbestos prospect, showing outcrops and location of workings, is shown as figure 9.

Description of Property

In the immediate vicinity of the prospect chrysotile-asbestos-bearing peridotite outcrops over a crescentic area about 900 feet in length and 300 feet in maximum width. In the south end of this area a bench has been cut

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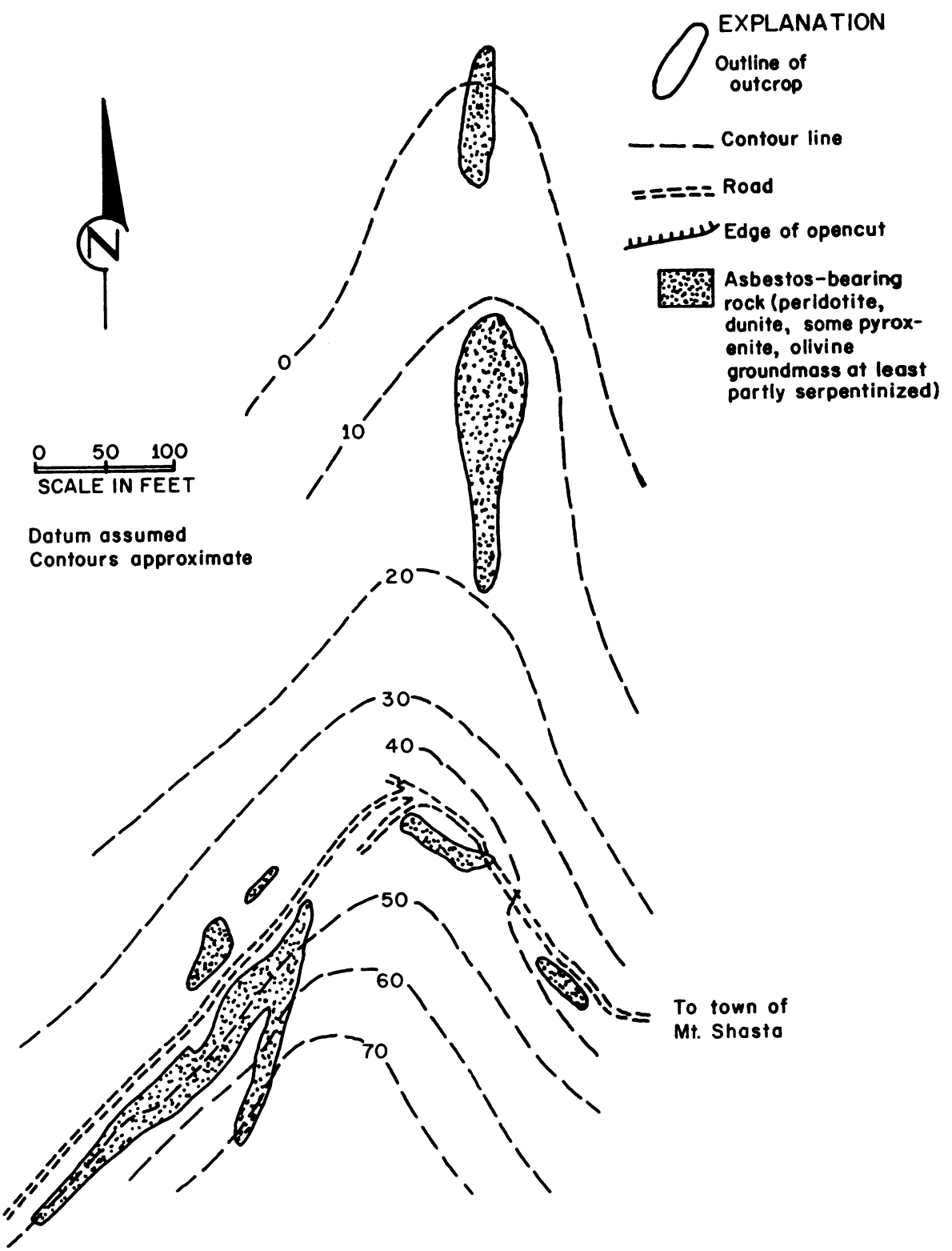

FIGURE 9. - Sketch of Mount Eddy Asbestos Deposit, Showing Outcrops and Location of Workings, Siskiyou County.
(From Geological Survey–Bureau of Mines Map.)

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into the deposit. This bench is about 200 feet long and about 50 feet wide, and the back is 10 to 30 feet high. A few small pits have been dug in other outcrops. About 200 tons of asbestos-bearing materials was sorted, and approximately half of it was shipped for test purposes. Some development work was conducted on the property in 1957 by the Cal-Ore Co.

Shasta View Prospect

Location and Accessibility

The Shasta View prospect (3, p. 265; 18, p. 421; 25, p. 419) lies in the Mount Eddy mining district. It is in the S1/2 sec. 8, T. 41 N., R. 5 W., in Siskiyou County. It is also known as the Sylvester asbestos deposit.

From Weed, Calif., the property is accessible by following U. S. Highway 99 westerly 3 miles to the Edgewood road, then turning southward and going 2.3 miles on the mail route, then turning right or westward and going 0.9 mile, then turning right or northerly and proceeding one-half mile to the mine. The general location of the Shasta View asbestos deposit is shown in figure 8.

Property and Ownership

The property consists of 10 unpatented claims formerly held by George C. Taylor, Yreka, Calif., and W. H. Gassoway, Granada, Calif., who sold the claims in 1950 to Norman Hartley, Box 71, Mount Shasta, Calif. A plan of the claims of the Shasta View asbestos property is shown as figure 10.

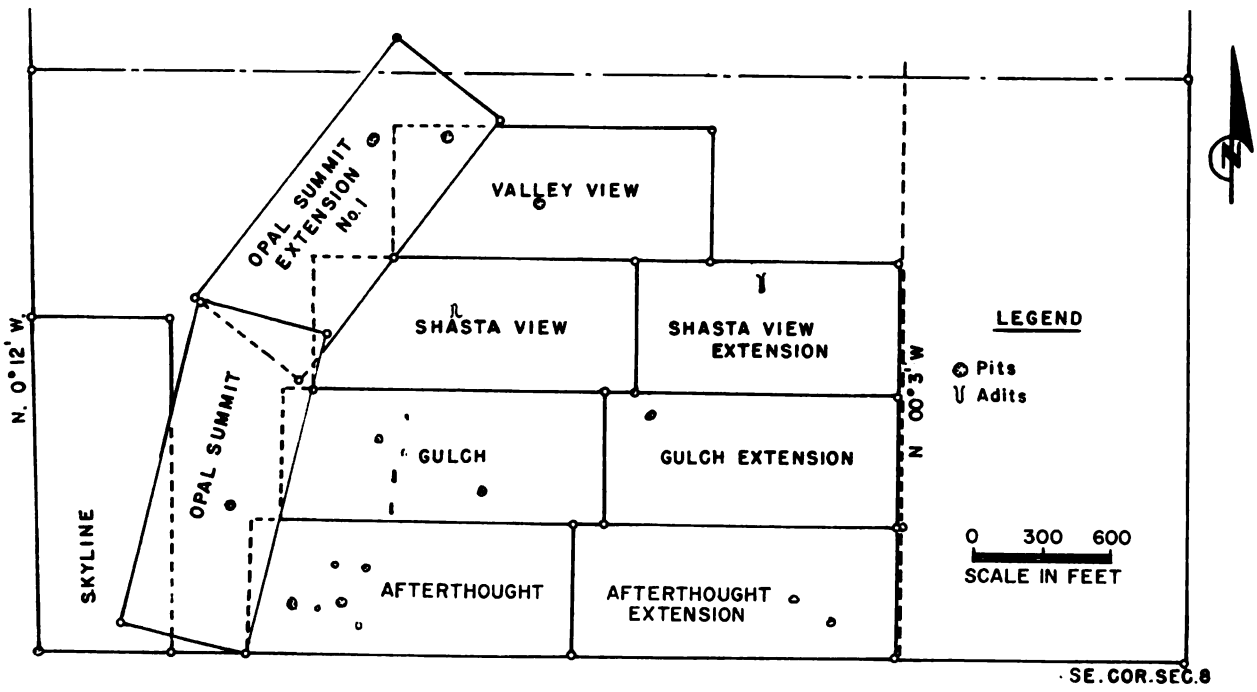

FIGURE 10. - Shasta View (Sylvester) Asbestos Claims, Siskiyou County.

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Geology and Ore Deposits

The entire area is covered by overburden. Work to date indicates that the claims probably are underlain by an irregular deposit of serpentine, containing a small number of stringers of chrysotile. The general trend of these stringers is due north, and they vary in dip from a vertical position to 65° E. A cut 30 feet long and 12 feet high in the upper workings contains 4 zones of asbestos-bearing rock, about 2 feet wide and containing numerous veinlets of chrysotile asbestos. The veinlets are very narrow, none exceeding a quarter of an inch. The ridge above the cut strikes N. 60° W. and is about 250 feet wide on top, and asbestos veinlets were found throughout its length of almost 1,500 feet.

The length of the chrysotile fibers ranges from minus-3/4- to plus-1/16-inch. The fibers are fine, a little harsh, and grayish-white. The gangue rock is an altered serpentine with inclusions of magnetite and chalcedony.

Description of Property

About 20 exploratory opencuts have been made along a horseshoe-shaped area formed by 2 eastward-trending ridges. These cuts are short and not over 16 feet deep but disclose an irregular deposit of serpentine containing stringers of chrysotile.

It has been reported that the National Cement Co. of Modesto, Calif., did some work on the property in 1921-22, when 10 tons of serpentine rock containing 25 percent of crossfiber chrysotile was obtained from a 60-foot adit on the Shasta View claim, owned at that time by H. S. Russell, Edgewood, Calif. This adit is now caved and inaccessible.

Metallurgical Tests

Metallurgical tests of material taken from the Afterthought Extension and Valley View claims were made by the Bureau of Mines Salt Lake City Station. The results of these tests follow.

Treatment

The minus-2-inch sample as received was stage-crushed and screened, and "fluffed" fibers were concentrated from screens by vacuum. Down to 3-mesh sample was hand-sorted and clean gangue removed. Stage crushing was continued to minus-14-mesh; screening and vacuum concentration were carried on down to minus-200-mesh. All vacuum concentrates were cleaned once by screening under vacuum. Fibers listed as "short" were collected during finer crushing operation. To obtain the "grade rating," a nest of Tyler screens and a Ro-Tap screening machine operated without the tapping device were used. The charge was proportioned to correspond with that used on a Canadian standard screening machine.

The results of this metallurgical test are shown in table 4.

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TABLE 4. - Metallurgical data, Shasta View asbestos prospect

Product	Weight, grams	Weight-percent	Assay, percent					Loss on ignition
			MgO	SiO_2	Al_2O_3	Fe_2O_3	Cr_2O_3	
Long fiber..	1,523	25.8	39.8	41.1	1.6	3.4	0.29	14.5
Short fiber.	310	5.2	38.75	41.6	1.53	5.67	.41	13.3
Rejects	4,081	69.	-	-	-	-	-	-
Total ...	5,914	100.						

Grade rating, 2-minute screening time

Mesh	Short fiber		Long fiber	
	Weight distribution, percent	Distribution, oz.	Weight distribution, percent	Distribution, oz.
+ 1/2-inch..	-0-	-0-	46.6	7.4
+ 4-mesh ...	16.5	2.6	36.	5.8
+ 10-mesh...	32.5	5.2	8.7	1.4
- 10-mesh...	51.	8.2	8.7	1.4
Calculated heads	100.	16.	100.	16.

Remarks: Fibers are high in iron, which is present partly as magnetite inclusions. Fibers are a little harsh rather than silky soft, and include some partly altered serpentine that does not fiberize readily. All these factors will affect the uses of the fibers and reduce their market.

Microscopic examination of the Sylvester asbestos shows that it is chrysotile. The asbestos can be described as the crossfiber form, which has the fibers arranged normal to the vein walls. The length of the fibers ranges from minus-3/4- to plus-1/16-inch. Petrographic studies of the fibers show that they are fine, but a minor amount of magnetite inclusions is associated between the fibers.

Mineralogically, the gangue rock is an altered serpentine with magnetite and chalcedony inclusions. At the contact of the veins in the gangue material is a concentration of magnetite grains. Numerous areas of the serpentine gangue are highly altered, and grinding may liberate this fraction, so as to contaminate the asbestos fibers.

Chemical analysis of the heads is not reported, since the gangue constituents of the ore contain the same elements as the asbestos. Test work showed 31.0 percent weight of the ore recovered as combined long-and short-fiber asbestos.

The long-fiber product represented 25.8 percent of the total weight of the ore, gave a grading of 7.4-5.8-1.4-1.4, and corresponds to Group 3, Spinning or Textile Fiber. This product assayed 39.8 percent MgO, 41.1 percent SiO_2, 1.6 percent Al_2O_3, 3.4 percent Fe_2O_3, and 14.5 percent loss on ignition, and conforms to the analysis of chrysotile asbestos.

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The short-fiber product gave a grading of 0 - 2.6 - 5.2 - 8.2 corresponding to Group 5, Paper Fiber, represented 5.2 percent of the weight of the ore, and assayed 38.8 percent MgO, 51.6 percent SiO_2, 1.5 percent Al_2O_3, 5.7 percent Fe_2O_3, and 13.3 percent loss on ignition.

Supplementary microscopic examination of the two fiber products showed that a considerable portion of the iron content was present as magnetite inclusions. Minor amounts of altered serpentine also occur as inclusions. The color appears quite uniform but is a grayish white, not a true white. The fibers are a little harsh rather than silky soft. These factors will affect the uses of the fibers and reduce their market value to less than the price for Group 5, Paper Fiber, and for Group 3, Spinning or Textile Fiber.

Calethia Group of Claims

Location and Accessibility

The Calethia group of claims is on the mountain slope north of the Middle Fork, Sacramento River, in the southern part of sec. 28, T. 40 N., R. 5 W., Siskiyou County. The general location of the group of claims is shown in figure 11.

The claims are 8.7 miles by road southwesterly of the city of Mount Shasta. They are accessible by automobile (provided bridges are not washed out) from Mount Shasta. Turn right at the southeast edge of the city at the Koffee Kup Cafe, and follow old U. S. Highway 99 south 0.4 mile. Turn right (west), and go 0.4 mile on the Perotshasta road. Then turn left on the Castle Lake road, and go 1.7 miles, at which point turn right, and go 4.2 miles, then right on the Middle Fork, North Fork Sacramento River Road, and go 1.5 miles, then right on the North Fork Sacramento River Road, 0.5 mile to the mine workings, which are a short distance above the Middle Fork.

Property and Ownership

The property consists of eight unpatented mining claims known as Calethia Asbestos group 1 to 8, inclusive; these claims are held by the Keystone Asbestos Corp., 1005 Investment Building, Washington, D. C.

Geology and Ore Deposits

The Calethia asbestos claims are underlain by a mass of serpentine. The serpentine, exposed by road and prospect cuts, is light greenish-gray, massive, and characterized by typical slickenside surfaces.

An opencut on the original discovery exposed crossfiber chrysotile asbestos occurring as seams in a zone of serpentine about 18 feet wide, which strikes N. 45° W. and dips steeply northeast. The dominant trend of the seams is parallel with the zone, although there are numerous random, irregular, fiber-filled seams. A section across the asbestos-bearing serpentine zone contained 32 seams ranging in width from 1/8 to 1-3/4 inches and averaging 1/2 inch, separated by barren serpentine layers 1 to 30 inches wide. The total width of

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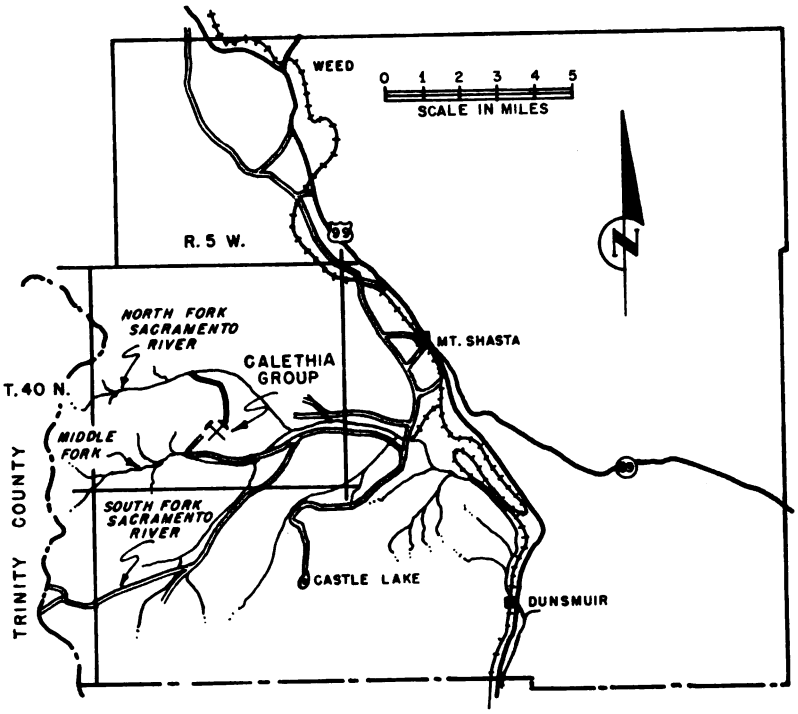

FIGURE 11. - Index Map Showing Location of Calethia Asbestos Mine, Siskiyou County.

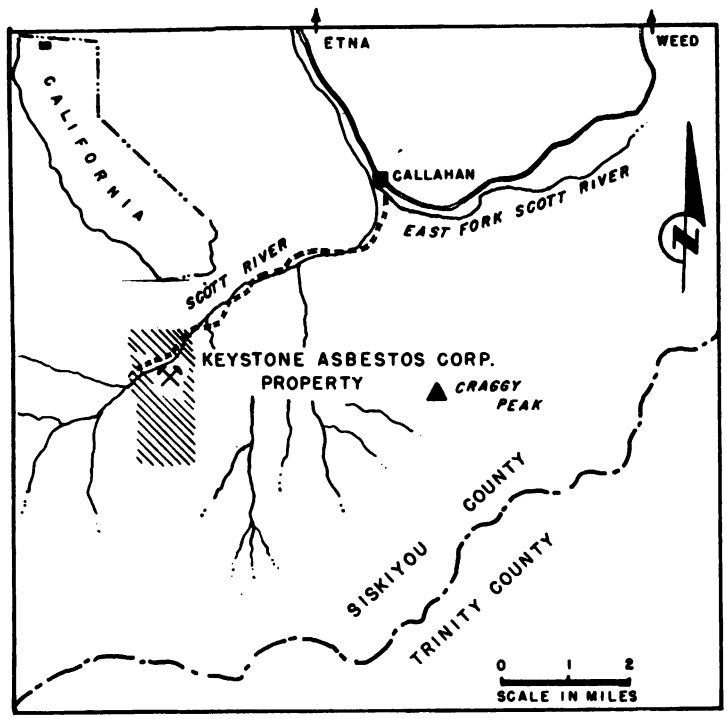

FIGURE 12. - Index Map Showing Location of Keystone Asbestos Corp. Property on Scott River, Siskiyou County.
(From Geological Survey Map.)

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asbestos fiber in the 18-foot section across the deposit was 17.5 inches, or about 8 percent fiber. The fiber length in most cases apparently would pass the requirements for Spinning grade, and the fiber strength appeared adequate.

However, the trenches cut above and below the original discovery contained only minor quantities of asbestos-bearing material. The length of the asbestos fiber is approximately 1/8 inch. The showings in these trenches apparently indicate that the deposit is very limited in size and may be confined to the area in the immediate vicinity of the original discovery.

Description of Property

The property is in the prospect stage. Exploration work consists of a bulldozer cut on the original discovery, which was then drilled and blasted to a depth of 18 feet at its face. Four bulldozer trenches above and 2 trenches below the original discovery were dug. These trenches are approximately 150 feet apart.

Keystone Asbestos Claims (Nos. 1 to 8, Inclusive)

Location and Accessibility

The Keystone Asbestos claims are situated in sec. 34, T. 40 N., R. 9 W., and secs. 2 and 11, T. 39 E., R. 9 W., M.D.B. & M., in Siskiyou County. They are accessible by a 4-wheel-drive automobile from Callahan by following 5 miles of dirt road southwesterly alongside the Scott River and then 1.5 miles of very rough and steep access mine road. The general location is shown in figure 12.

Property and Ownership

The property consists of six unpatented claims known as the Keystone Asbestos claims, Nos. 1 to 8, inclusive. They are held by Curtis Fowler, George J. Petrow, George C. Vournas, C. J. Petrow, and George Payne. On June 26, 1953, the claims were leased to the Keystone Asbestos Corp., 1005 Investment Building, Washington, D. C.

Geology and Ore Deposits

The Keystone Asbestos claims lie in an area underlain by ultrabasic rocks with 2 to 10 feet of overburden covering the steep slopes. Serpentine, the bedrock, is greenish-black, showing typical slickensided surfaces, and is crisscrossed by veinlets of crossfiber chrysotile asbestos. The country rock is a serpentinized peridotite.

Chrysotile asbestos occurs as crossfibers in veinlets in the serpentine. As the exposed veinlets strike and dip in all directions, it is impossible to recognize any structural patterns in the deposit. In the discovery trench the veinlets range in thickness from 1/8 to 3/4 inch; elsewhere, the average thickness of the veinlets is less than 1/8 inch.

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The diamond-drilling project revealed that the downward continuation of the asbestos-bearing serpentine, exposed in the surface cuts, does not contain commercial amounts of asbestos. None of the cores exposed commercial crossfiber asbestos.

Description of Property

The surface workings consist of 3 bulldozer trenches and 4 pits. Two of the trenches penetrated fresh unweathered serpentine. With assistance from the Defense Minerals Exploration Administration (DMEA-3096, Idm-E623), the company explored a mineralized area previously uncovered. Five diamond-drill holes totaling 572 feet were drilled to test the vertical extent of the mineralized serpentine. All of the cores contained some asbestos.

A sketch of the plan showing workings and location of diamond-drill holes is shown in figure 13. Sections through the diamond-drill holes are shown in figure 14.

The best showing of chrysotile was in hole 1, which contained about 3 percent crossfiber. The maximum length of this fiber was 3/8 inch, and the average was 1/8 inch.

C. C. Cady Prospect

The Cady prospect (3, p. 264; 18, p. 421; 25, p. 418) is on Greenhorn Mountain between Yreka and Fort Jones. It is in sec. 23, T. 45 N., R. 8 W. In 1923 it was leased to George Souze, who did some work. No development has been done since 1935.

Chamberlain (Burns) Ranch Prospect

The Chamberlain (Burns) ranch (3, p. 264; 18, p. 421; 25, p. 218) includes 800 acres of patented land about 4 miles southwest of Gazelle in secs. 16, 17, and 20, T. 42 N., R. 6 W., owned by C. C. Chamberlain. A light-green, brittle chrysotile asbestos in bands up to 3/8 inch wide occur in dark-green serpentine, exposed in a trench 5 feet wide, 20 feet long, and 3 feet deep.

TRINITY COUNTY DEPOSITS

Chrysotile and amphibole asbestos are known to occur in some of the large areas of serpentine in the northeastern part of Trinity County. A chrysotile-asbestos deposit has been located in an area of serpentine south of Red Mountain in the southern part of the county. Much of Trinity County is unmapped and remote sections have not been thoroughly prospected.

The total production of asbestos from Trinity County has amounted to a few tons of chrysotile asbestos produced about 1930.

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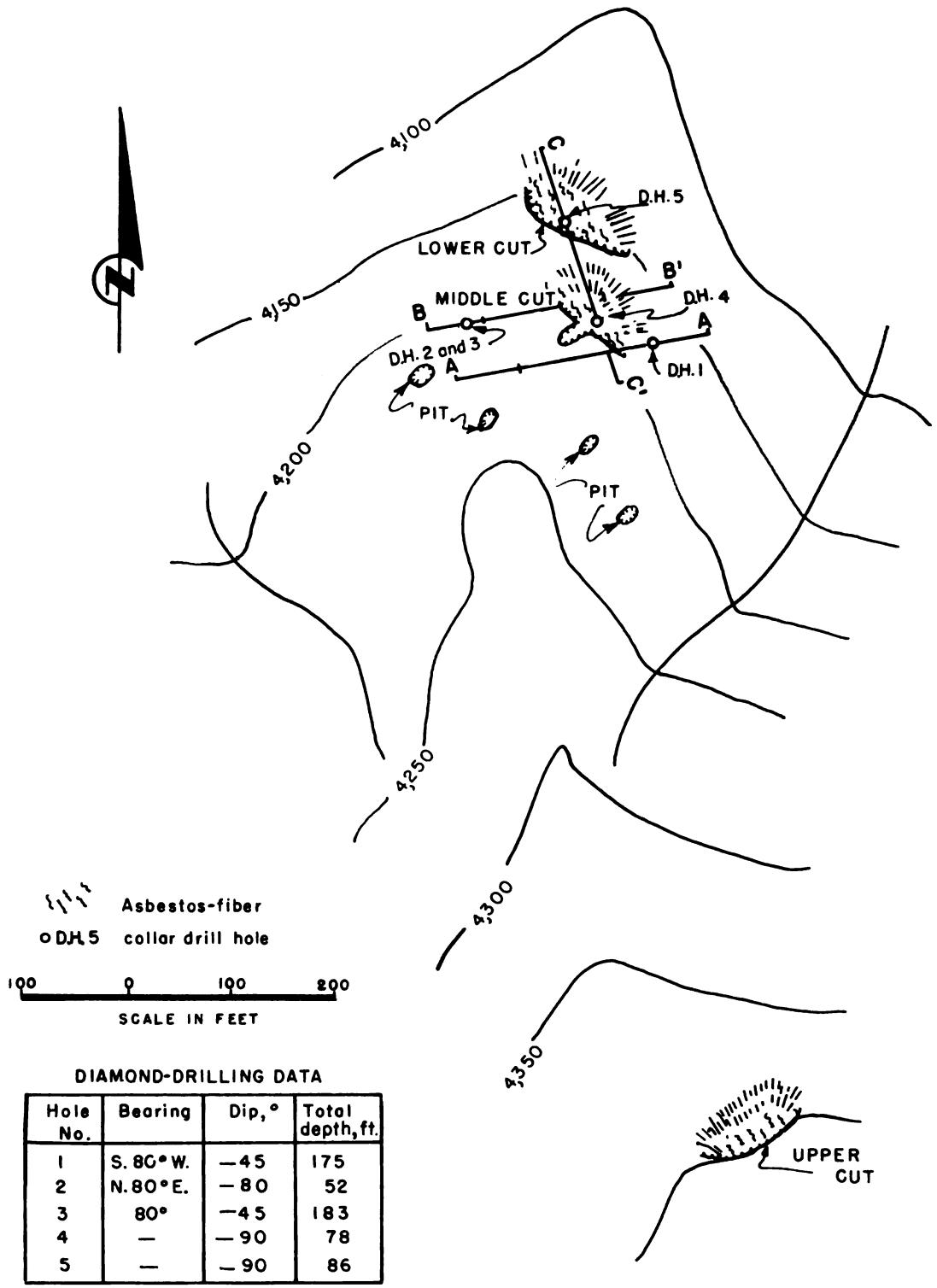

DIAMOND-DRILLING DATA

Hole No.	Bearing	Dip, °	Total depth, ft.
1	S. 80° W.	—45	175
2	N. 80° E.	—80	52
3	80°	—45	183
4	—	—90	78
5	—	—90	86

FIGURE 13.—Plan Showing Workings and Location of Diamond-Drill Holes, Keystone Asbestos Claims, Siskiyou County.

(Prepared by Geological Survey From DMEA Map.)

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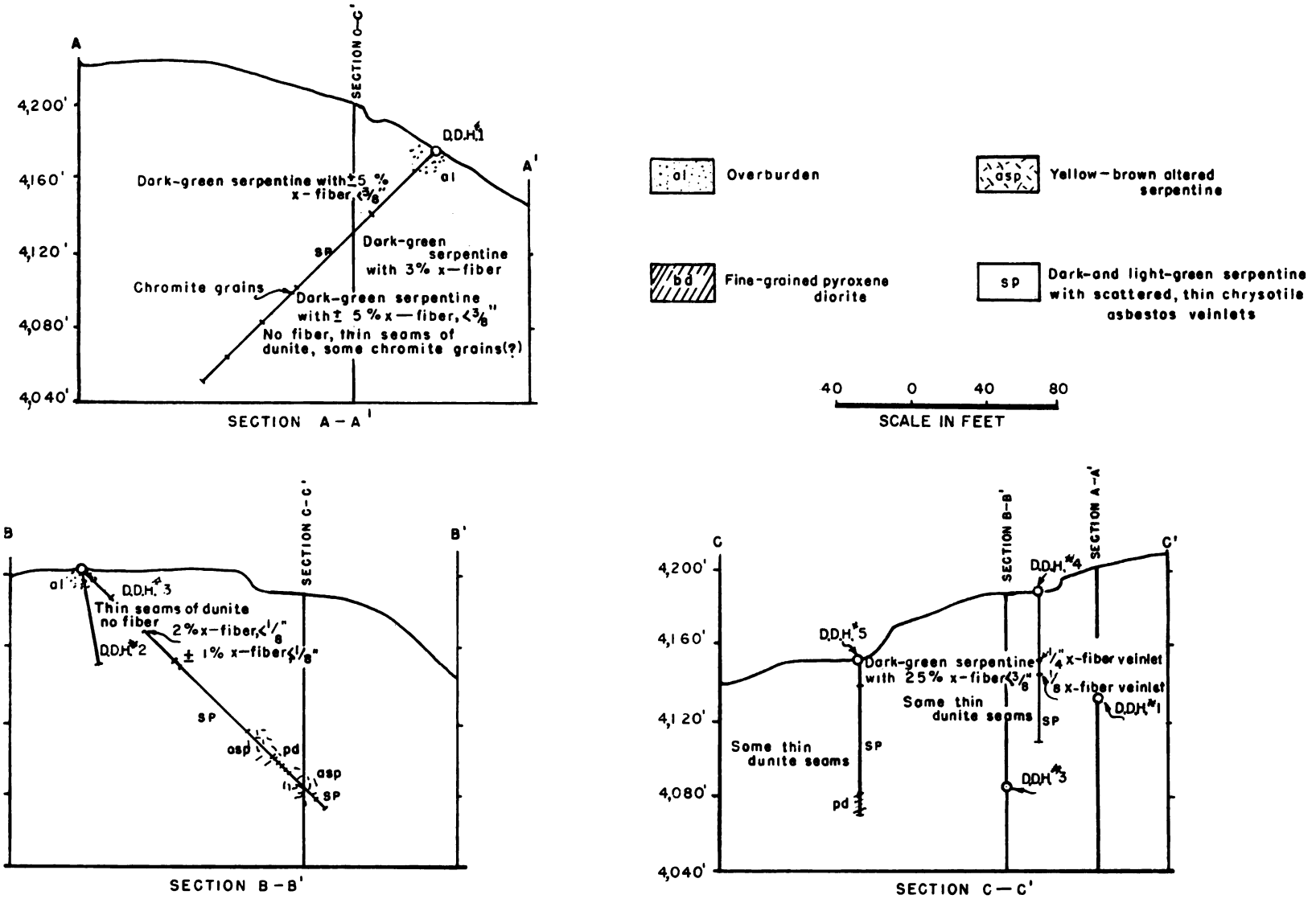

SECTIONS THROUGH DD HOLES

FIGURE 14. - Sections Through Diamond-Drill Holes, Keystone Asbestos Claims, Siskiyou County.
(Prepared by Geological Survey From DMEA Map.)

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Trinity Asbestos Claims

Location and Accessibility

The Trinity Asbestos claims lie in sec. 5, T. 37 N., R. 5 W., and sec. 32, T. 38 N., R. 5 W., M.D.B. & M., in Trinity County.

The claims are accessible from Whalan Station, which is 12 miles westerly via a good gravel road from Castella, a town on U. S. Highway 99. From Whalan Station follow a logging road south for 6.5 miles, then turn left on an access mine road, and go 2 miles to the property. The claims are a few hundred feet east of Tamarack Lake. Figure 15 shows the location of the property.

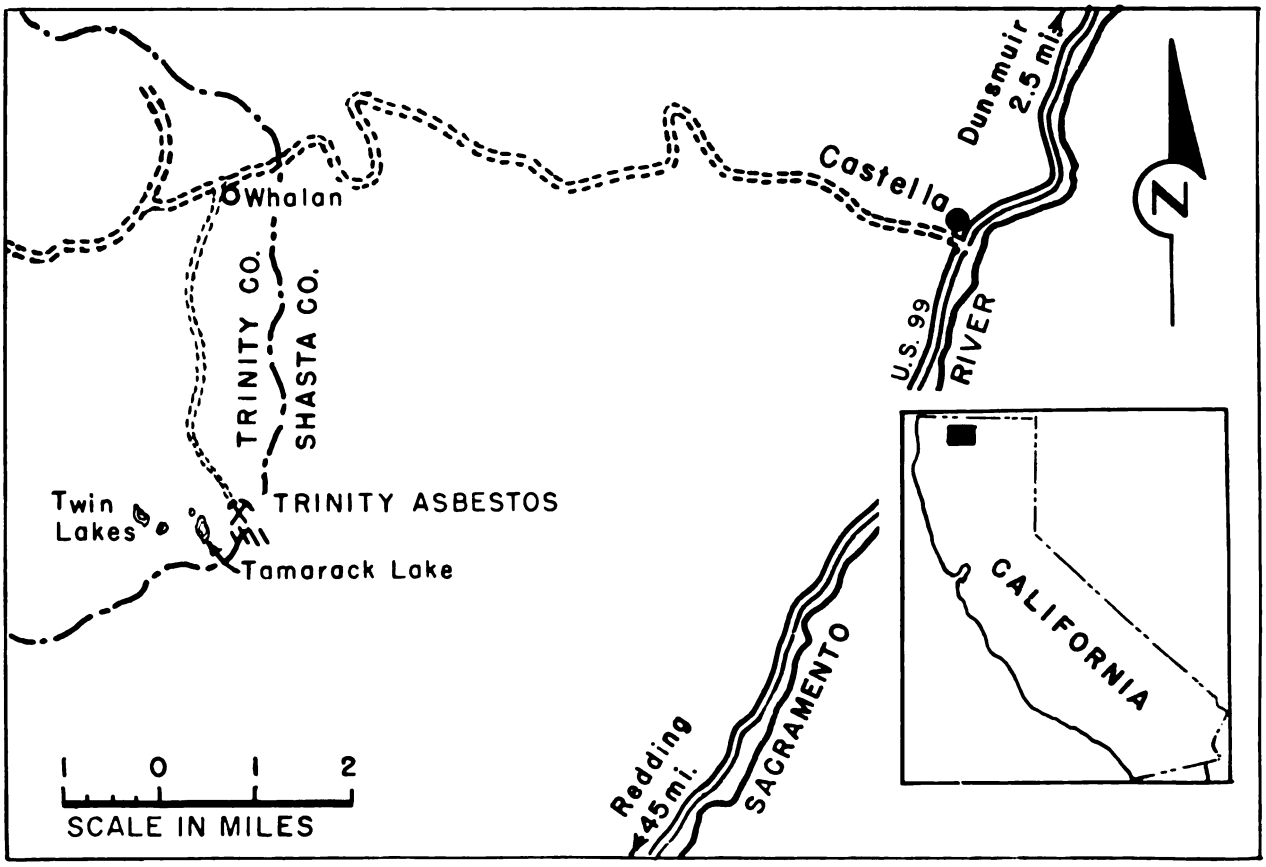

FIGURE 15. - Index Map Showing Location of Trinity Asbestos Claims, Trinity County. *(From Geological Survey Map.)*

Property and Ownership

The property consists of the Trinity Asbestos claims, Nos. 1 to 8, inclusive. The claims are unpatented and are held by J. F. McKee and Edith McKee of Coos Bay, Oreg., Jack A. and Elizabeth Dalton of Walla Walla, Wash., and E. S. and Rose Baker of Delta, Calif. The Keystone Asbestos Corp., 1005 Investment Building, Washington, D. C., obtained a lease on the property August 24, 1952.

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Geology and Ore Deposits

The Trinity Asbestos claims are in an area underlain by ultrabasic rocks. The exposures of bedrock surrounding the mineralized area are of peridotite, exhibiting varying degrees of serpentization. Color ranges from greenish-black in the unaltered rock to pale green in the highly sheared and altered serpentine.

The property is overlain by 1 to 3 feet of soil and slope wash, which contains boulders of porphyritic hornblende diorite. This intrusive rock outcrops 1/4 mile away on 3 sides of the mineralized area.

Chrysotile asbestos, as slip fibers, occurs in fractures and joints in the serpentine. Locally the fibers are 3 inches long, but commonly average 1 inch in length.

Description of Property

The principal working in the area consists of a bulldozer trench. The bedrock in this trench has been blasted to a depth of 2 to 6 feet. The most favorable asbestos-bearing fractures trended west and dipped south. Diamond drilling under DMEA did not disclose any downward continuation of the west-striking mineralized zone.

With assistance from the Defense Minerals Exploration Administration (DMEA-3095, Idm-E624), the company in 1954 explored the mineralized zone in the above-mentioned area. Five diamond-drill holes, aggregating 371 feet in length, were drilled to test the downward extent of the mineralized zone shown in the bulldozer trench. Some slip fiber was found in the cores from holes 2, 3, and 4. Hole 4 had the best showings, with traces of chrysotile between the 11- and 28-foot interval reaching a maximum length of 1/8 inch. Hole 5, collared directly over a strong fiber-bearing fracture, was abandoned at a depth of 8 feet when the fiber reached the vanishing point. Upon completion of the DMEA contract work, the drill holes were loaded with dynamite and blasted. The blast produced new exposures of serpentine but did not reveal commercial amounts of asbestos. The locations of the diamond-drill holes are shown in figure 16. Sections through the diamond-drill holes are shown in figure 17.

Red Mountain Deposit

Location and Accessibility

The Red Mountain deposit is situated in sec. 33, T. 26 N., R. 12 W., in the Mad River mining district of Trinity County. It is about 2 miles south of Red Mountain and lies near the top of a northerly trending ridge at an elevation of about 4,200 feet. It is accessible from Covelo by following a county road to a point on the North Fork of the Eel River, thence via a private road to the Travis Ranch and about 2 miles beyond this ranch to the deposit. The private roads are very steep and are impassable during the winter months of rain and snow. The nearest town is Covelo, 30 miles by road distant from the

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DIAMOND-DRILL-HOLE DATA

Hole No.	Bearing	Inclination, °	Depth, ft.
1	N	−60	100
2	N.10°E.	−60	100
3	N.42°E.	−60	97
4	W.	−40	66
5	—	−90	8

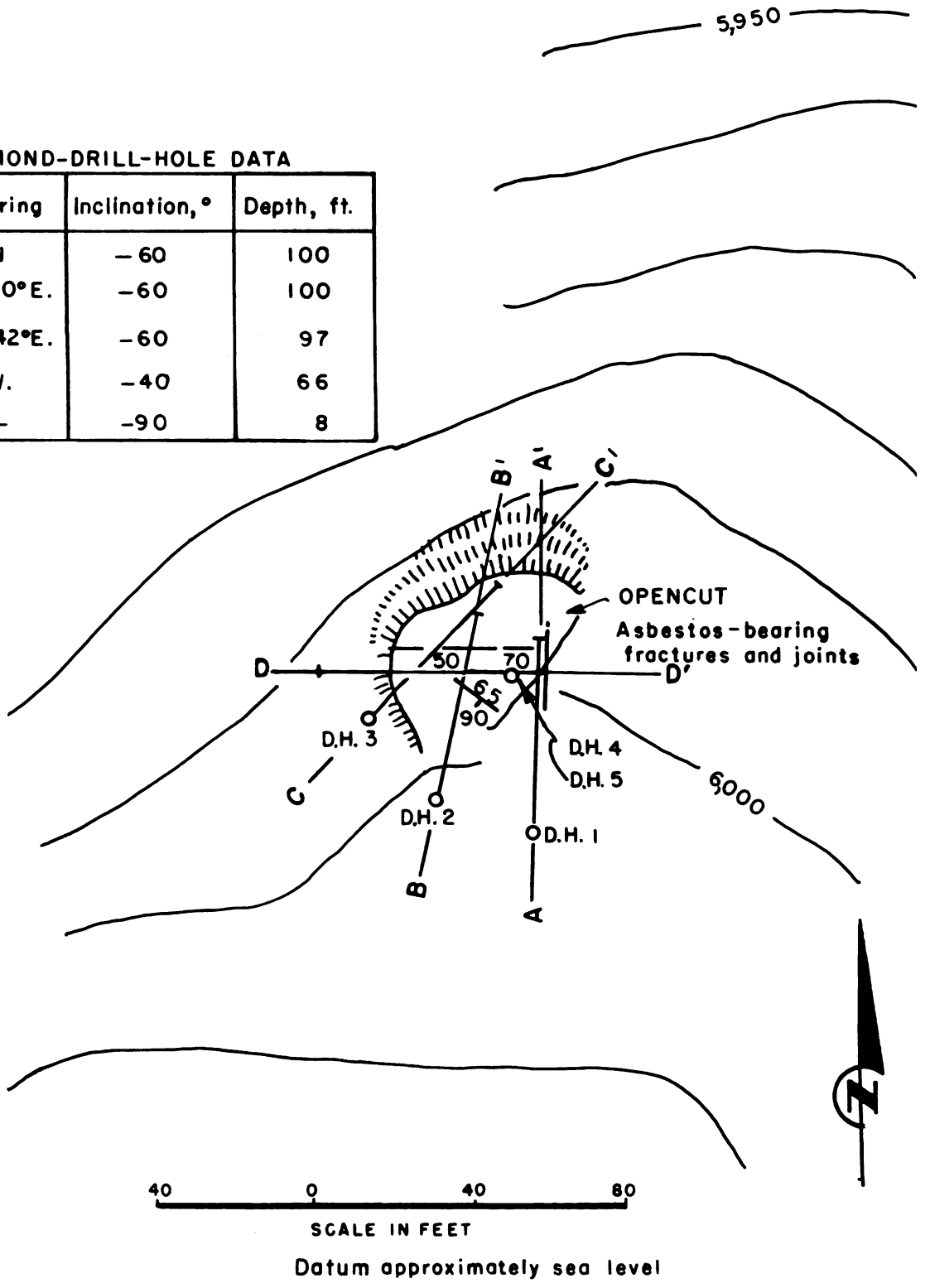

FIGURE 16. - Map Showing Location of Diamond-Drill Holes, Trinity Asbestos Claims, Trinity County *(Prepared by Geological Survey From DMEA Map.)*

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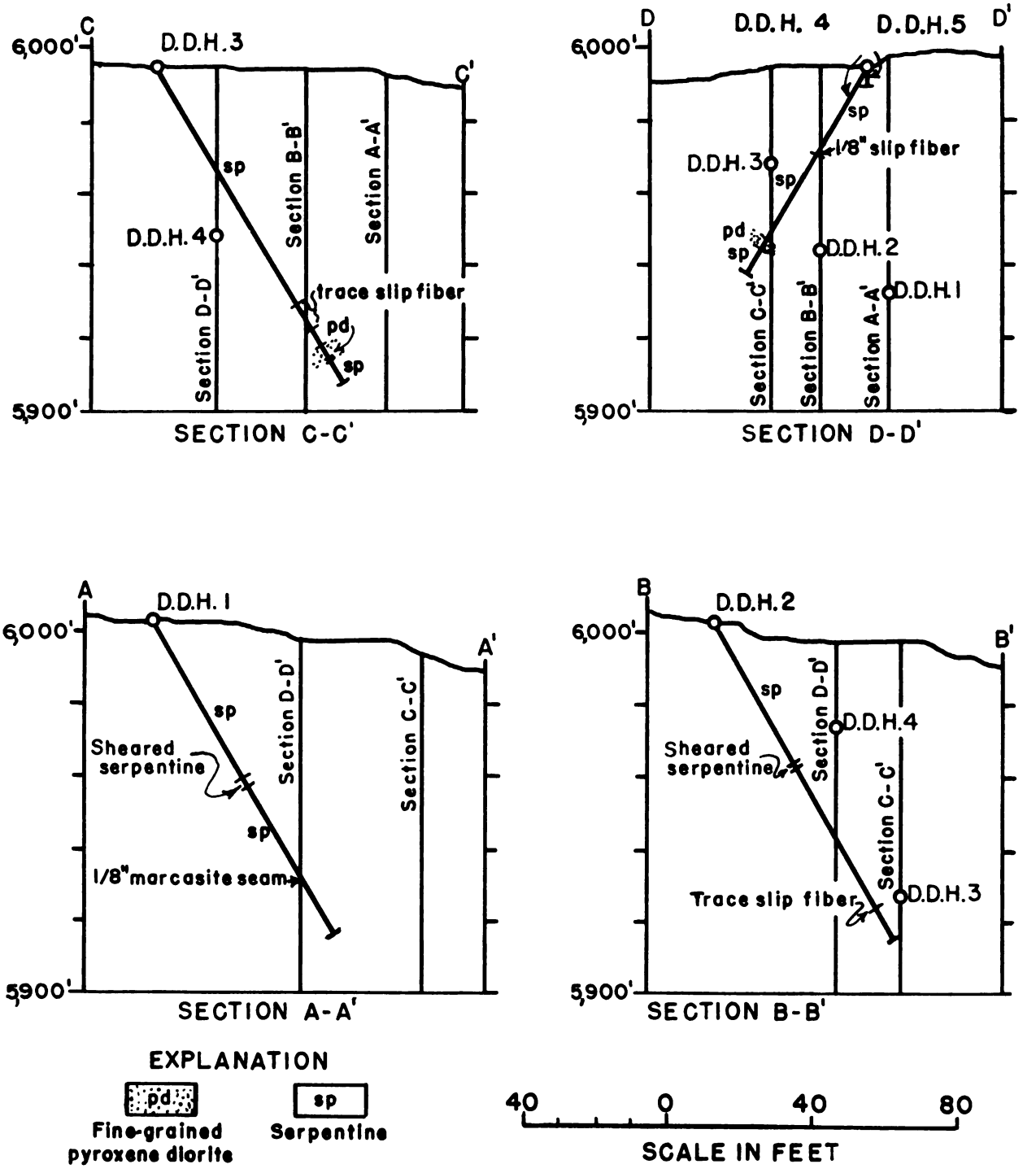

FIGURE 17. - Sections Through Diamond-Drill Holes, Trinity Asbestos Claims, Trinity County. *(Prepared by Geological Survey From DMEA Map.)*

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deposit. The Northwestern Pacific Railroad passes within 14 air miles west of the property, but the nearest rail point is Dos Rios, 45 miles to the southwest. The location of the deposit is shown in figure 18.

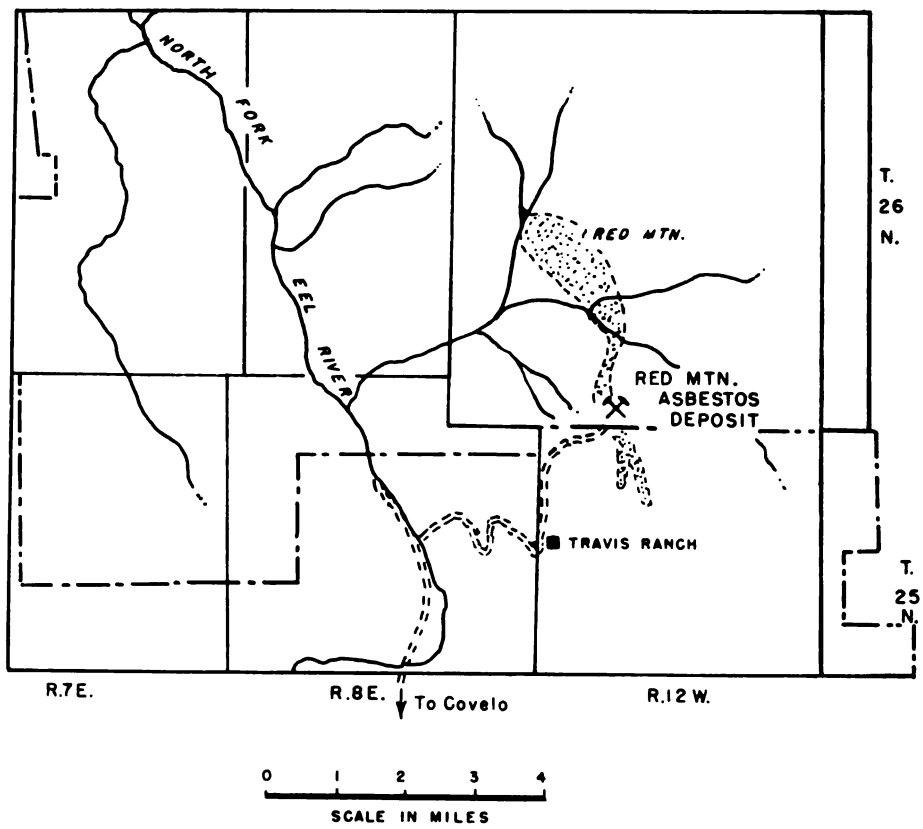

FIGURE 18. - Index Map Showing Location of Red Mountain Asbestos Deposit, Trinity County.
(From Geological Survey Map.)

Property and Ownership

The Red Mountain deposit is included in 13 mining claims in sec. 33, T. 26 N., R. 12 W., and in sec. 5, T. 25 N., R. 12 W. The claims are known as the Virginia Bruce mining claims, Nos. 1 through 13. The owners, G. L. Carrico and Bruce L. Codding, acquired the claims by location in 1949 and 1950. Bruce L. Codding's address is: Bar Z ranch, Covelo, Calif., and also 3101 Sonoma Ave., Santa Rosa, Calif.

Geology and Ore Deposits

The area is underlain by metasediments comprised of sandstone, conglomerates, slates, and cherts, which are intruded by ultrabasic sills. The Red Mountain asbestos deposits are situated in the south end of the Red Mountain ultrabasic intrusive, which has a length of about 3-1/2 miles and a width of 1 mile at its north end. The south half of the intrusive, in which the asbestos deposits occur, has a sill-like structure about 1/4 mile in width. The ultrabasic rocks vary in composition from dunite through peridotite to pyroxenite. The dunite and peridotite are largely altered to serpentine.

The asbestos veins occur mainly in shear fractures in the serpentine. The asbestos-bearing serpentine is so sporadic and occurs in such small quantities that no single deposit is large enough to warrant mining under present conditions. The asbestos veinlets are more abundant on the surface than internally, and the average length of the crossfiber chrysotile asbestos will average about 1/4 inch. A very small percentage of the fiber is 1/2 inch in length. One of the larger of the sporadic deposits, about 10 feet by 150 feet in size, contains

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about 2 percent of fiber of average length of 1/4 inch and a maximum length of 1/2 inch.

In the first 50 feet of an exploration trench, in another area, the hard masses of serpentine contain crossfiber veins of asbestos up to 1/2 inch in length and have in some instances an asbestos content of 10 percent.

Description of Property

The property has been developed by surface stripping and the excavation of 17 trenches.

Trenches 1 and 2 revealed a fiber zone 10 feet wide and 150 feet long near and parallel to the north contact. The widest vein observed was 1/2 inch, but most of the veins will average 1/4 inch in width.

Trench 13 exposed 50 feet of hard masses of serpentine, containing veins of asbestos up to 1/2 inch wide. Trenches 16 and 17 indicated a maximum width of the asbestos zone in their locality as 75 feet. A sketch of the plan of the deposit is shown in figure 19.

Jones Bros. Mine

Location and Accessibility

The Jones Bros. mine (2, p. 26; 5, p. 16) is situated in sec. 7, T. 37 N., R. 7 W., Trinity County. It is accessible from Carrville by going north 1/2 mile to the bridge across Coffee Creek, then following a path along an old flume on the south side of the creek westward for 1/4 mile to the mine.

Property and Ownership

The mine consists of two claims known as the Chrysotile and Chrysotile No. 1 and is on land owned by the Southern Pacific Land Co.

In 1930 it was leased by the Jones Bros. Asbestos Supply Co. of San Francisco, which operated the property. At that time, five men were at work sorting the asbestos. Two tons of asbestos had been shipped, and 5 tons was sacked for shipment.

Geology

The claims lie in the southeastern portion of a large mass of serpentine. The eastern edge of this serpentine mass is in contact with gabbro. Crossfiber chrysotile asbestos is found on the property in irregular fractures in a dark-green, greasy-looking serpentine. The asbestos is a green chrysotile of very good quality, with considerable strength of fiber. The fiber recovered is said to have varied from 1/4 inch to 2 inches in length, with an average of 3/4 inch. In examining the area above the caved working, very little fiber can now be seen.

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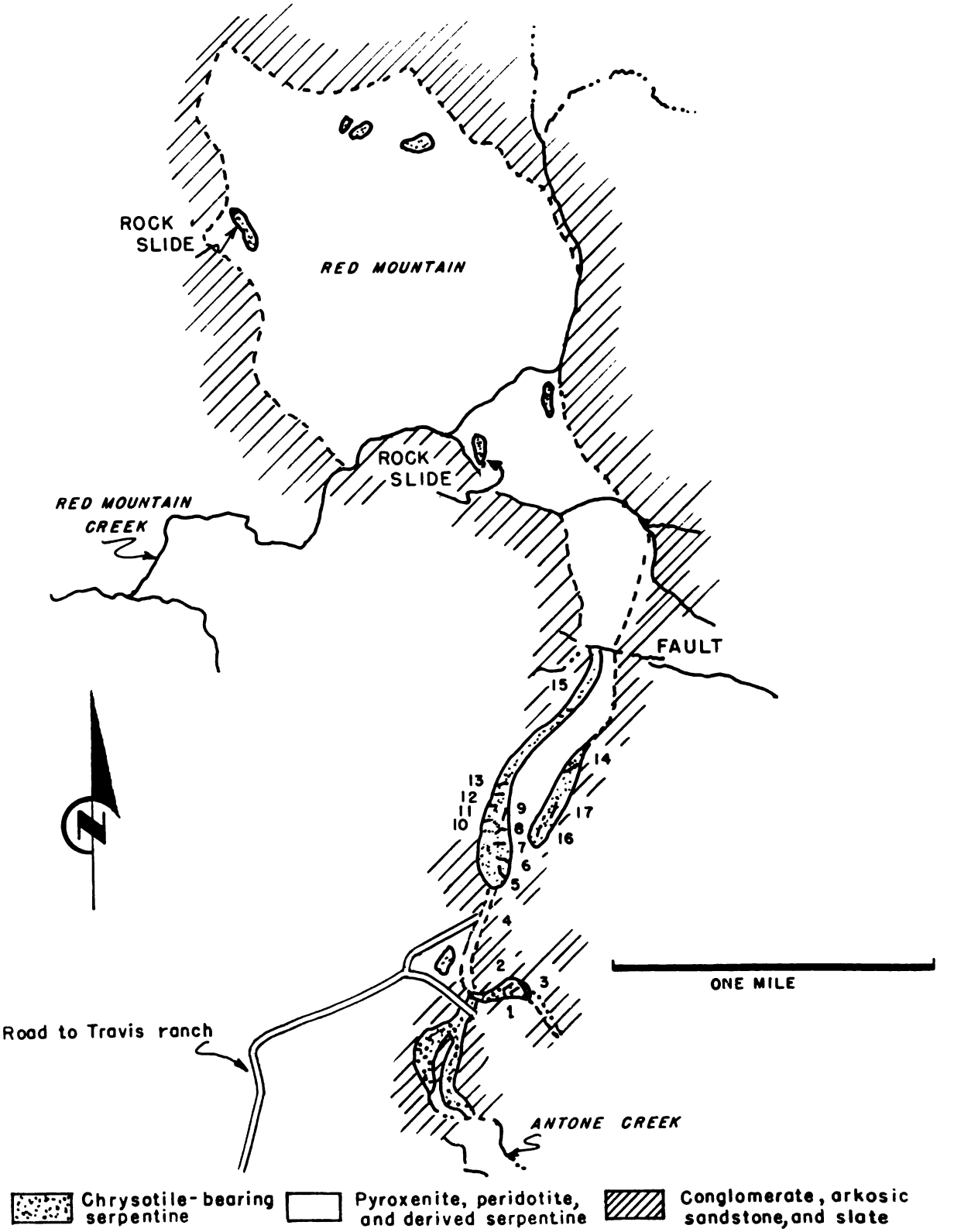

FIGURE 19. - Plan of Red Mountain Asbestos Deposit, Trinity County.
(From Philip Carey Mfg. Co. Map.)

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Description of Property

The asbestos production came from an 8- by 20-foot opencut 7 feet deep. A 100-foot prospect adit, a few feet below this cut, showed nothing but serpentine. Both workings are now caved. This property has been idle since 1931.

Prospects Near Altoona Quicksilver Mine

Amphibole asbestos occurs at a number of places near the Altoona quicksilver mine (21, p. 26; 5, p. 16; 19, p. 12) at distances of 5 to 15 miles from it. About 1914 a company spent some money for equipment and prospecting upon claims near the East Fork of Trinity River in the vicinity of the Altoona mine, but their operations proved unsuccessful.

White Cloud Amphibole-Asbestos Prospect

The White Cloud amphibole-asbestos prospect is in sec. 13, T. 38 N., R. 6 W. It is about 1/4 mile north of the road from Castella to the Altoona quicksilver mine and is near Asbestos Gulch. It is owned by Emile Chestang of Colusa, Calif.

The deposit consists of a zone of weak, weathered amphibole asbestos, striking N. 20° E. and varying from 1 to 4 feet in width. Some asbestos has been recovered from the prospect work.

TUOLUMNE COUNTY DEPOSITS

Serpentine, the host rock of chrysotile asbestos, outcrops in Tuolumne County as a series of individual masses lying in 2 belts 2 or 3 miles apart, which extend almost across the southwestern end of the county. Deposits of chrysotile asbestos of possible economic value have been located in parts of this serpentine area. The county had a small recorded production in 1953.

Ashley Property

Location and Accessibility

The Ashley property is in secs. 1 and 2, T. 2 S., R. 15 E., in southern Tuolumne County. It is reached from Sonora by traveling 10 miles southwest on State Highway 108 and thence 15 miles southeast on State Highway 49. At this point the Access Lode claim of the property lies adjacent to Highway 49, and its long axis extends 1,500 feet northeast, where it adjoins the side lines of Asbestos and Asbestos No. 1 claims. The location of the property is shown in figure 20.

Property and Ownership

The property consists of the Asbestos, Asbestos No. 1, and Access Lode claims owned by Lloyd C. Ashley, Palmer C. Ashley, and Robert F. Ashley, doing business in the State of California as Ashley Asbestos Association, Ltd. They are subject, however, to an option agreement made in 1953, which provides for ultimate purchase by The Flintkote Co., 30 Rockefeller Plaza, New York 20, N. Y.

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Geology and Ore Deposits

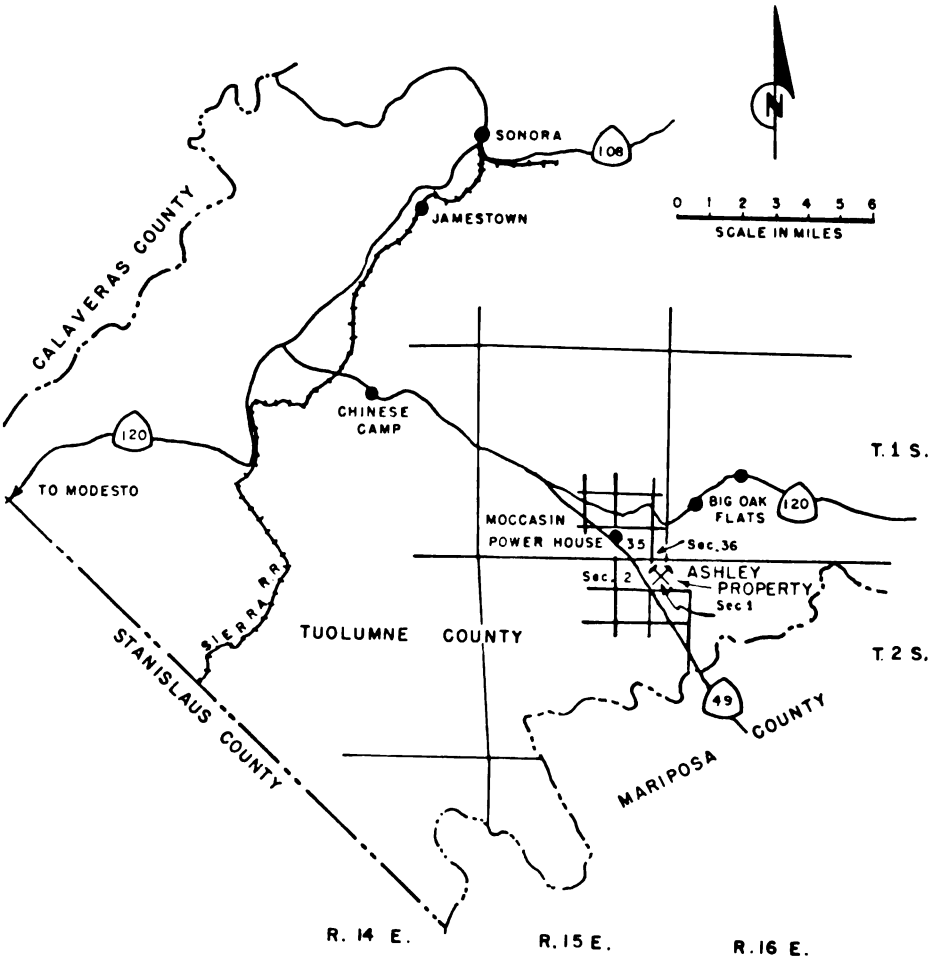

FIGURE 20. - Index Map Showing Location of Ashley Asbestos Mine, Tuolumne County.

The Ashley Asbestos claims are underlain by an elongated mass of asbestos-bearing serpentine lying along the Mother Lode fault zone. Slates, shales, and sandstones of the Mariposa formation outcrop in small patches along the western margin of the property. These rocks strike northwest and dip steeply northeastward under the serpentine, which is dark greenish-gray, massive, and forms an elongate band about 200 feet wide across the property. Overlying the serpentine body on the east is a dike of soda-syenite made up of albite with porphyritic crystals of plagioclase. A heavy overburden of slope wash and thick brush cover most of the exposures.

Seams of chrysotile asbestos up to 1/2 inch in thickness occur locally in the lower half of the serpentine body for a strike length of about 1,500 feet. Except for one small exposure in an old railroad cut, the asbestos-bearing serpentine was not observed to outcrop on the property, but its presence beneath the thick overburden is evidenced by abundant fragments and boulders of asbestos-bearing material in the slope wash. The estimated grade of the asbestos-bearing material in the float is from 5 to 10 percent visible asbestos. A picked sample of serpentine taken by the Bureau of Mines in 1943 was roughly 15 percent asbestos fiber, ranging from 0.005 inch to a maximum of 0.5 inch in length, although less than 1 percent was in the 0.25- to 0.5-inch fiber-length range. A simulated mill test run by the Bureau of Mines showed a screen distribution equivalent to Group 7 on the Quebec Asbestos Producers' Association scale; that is, for a 16-ounce sample 0.0 oz. plus-1/2-inch, 0.0 oz.

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plus-4-mesh, 3.7 oz. minus-4-, plus-10-mesh and 12.3 oz. minus-10-mesh. Group 7, which is classed as refuse or "shorts," tests 0-0-5-11 or below.

Description of Property

There are no buildings or mine equipment on the property. It has been developed by several shallow pits and trenches dug in the slope wash, which are now caved and filled with overburden. A sketch of the plan and section of the asbestos deposit is shown in figure 21.

Premier Asbestos Mine

Location and Accessibility

The Premier mine is in the low foothills bordering the Sierra Nevada Mountains on the west. It is in secs. 8 and 9, T. 1 N., R. 14 E., Tuolumne County, and is about 2 miles northwest of Jamestown and about 6 miles southwest of Sonora.

The property is accessible from Sonora by following State Highway 108 westerly 4 miles to the Tuttletown turnoff. From this point, the Tuttletown road is followed north and west 2 miles to the old Rawhide mine. The Premier Asbestos Co. property adjoins the Rawhide mine on the west, and the present workings are reached by newly constructed service roads.

Property and Ownership

The deposit is in an area which formerly was a large producer of gold from such properties as the Rawhide mine, controlled and owned by the Central Land Co. of Patterson, Calif. The Premier asbestos property comprises three quarter sections and was leased from the Central Land Co. by Mark Hanna and H. D. Castle, Angels Camp, Calif., and Frank Reed, 1130 Encina Drive, Modesto, Calif., in April 1952.

The deposit is large, and its future development depends upon finding profitable commercial uses of its product.

Geology and Ore Deposits

Rocks exposed in the area comprise a thick belt of serpentine which on the east contacts amphibolite schists and slates. To the southwest, the formations are intruded by dikes and sills of metadiorite, andesite, tuff, breccia, and conglomerates. Table Mountain to the east and south rising about 300 feet above the surrounding country is composed largely of latite.

Included in the serpentine belt there is an antigorite variety of serpentine 1/4 mile wide and 3/4 mile long that is cut in places by small seams and stringers of crossfiber chrysotile 1/8 to 1/4 inch thick. The antigorite variety of serpentine occurs as a plug or possibly a sill that dips about 70° east.

Description of Property

The deposit has been developed by 3 pits in an area about 1,000 feet square. The pits are 30 to 75 feet in diameter and from 10 to 20 feet in depth. They are situated on the south slope of Bear Creek Canyon. A few tons of antigorite were shipped to Los Angeles, Calif., for testing in 1953.

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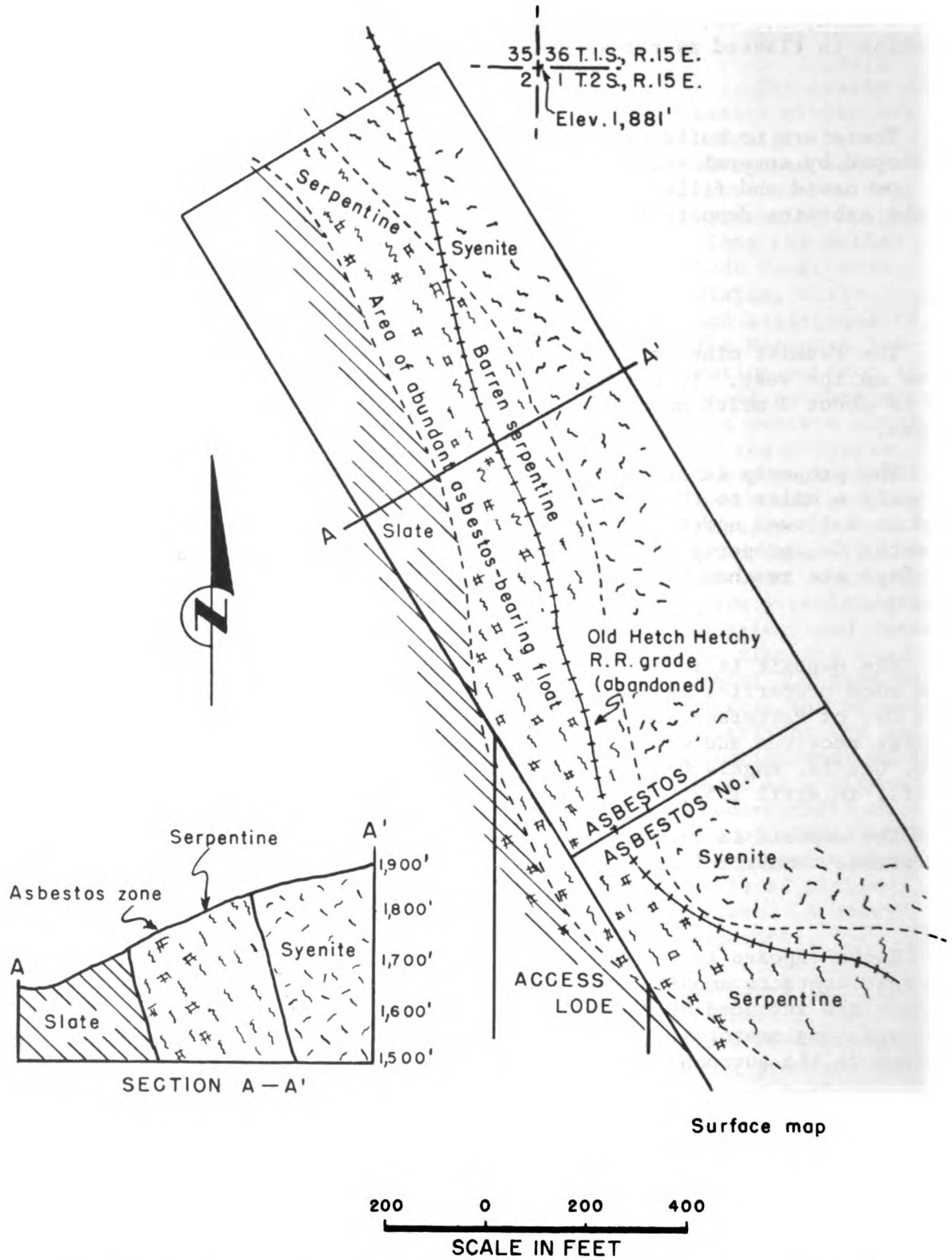

FIGURE 21. --Plan and Section, Ashley Asbestos Deposit, Tuolumne County.
(From Company and Geological Survey Map.)

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